Planning for Drought

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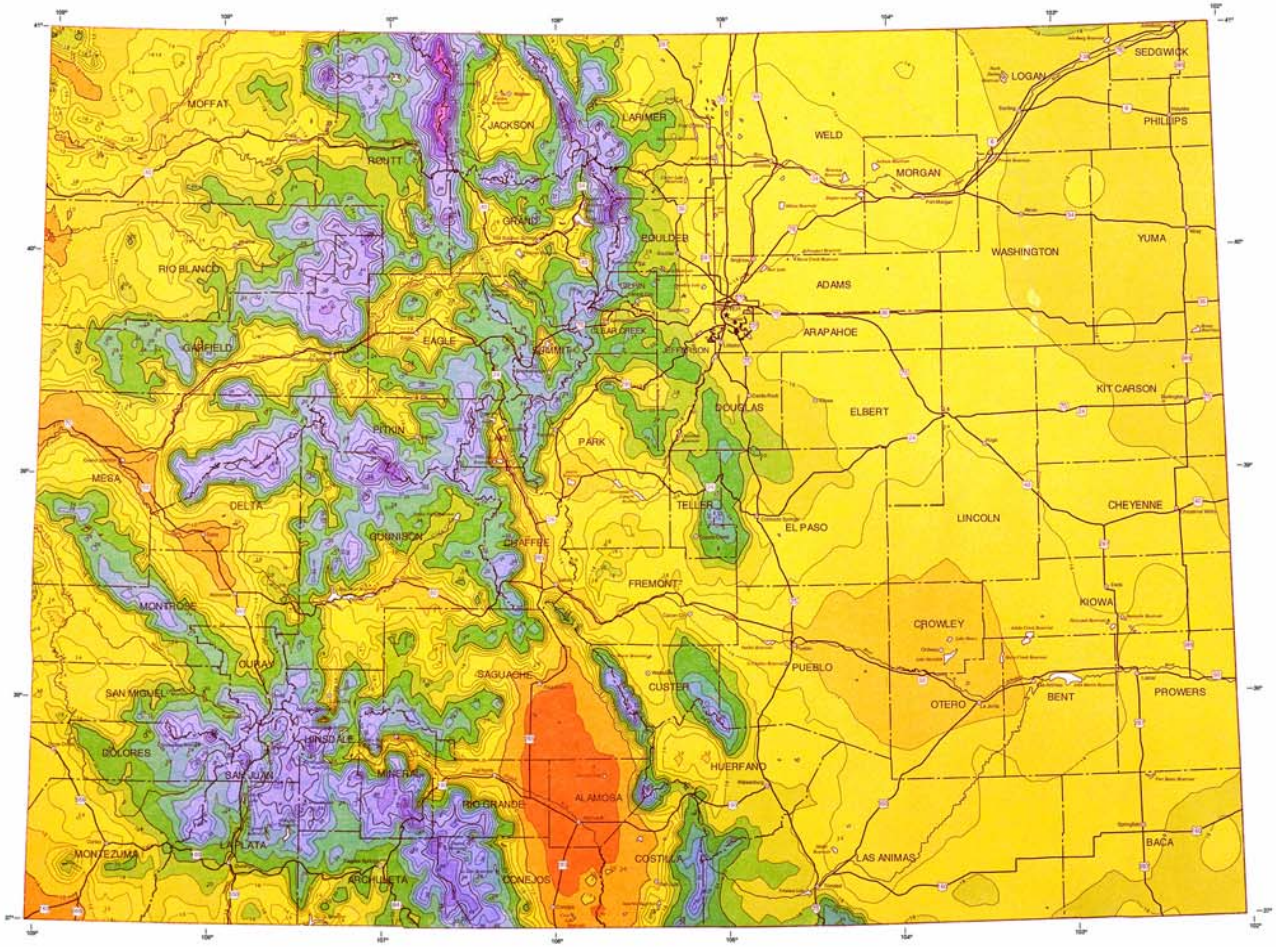
http://climate.atmos.colostate.edu

Key Features of the Climate of Colorado

U.S. DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

COLORADO
ANNUAL PRECIPITATION



Average Annual Precipitation 1961 - 1990 inches per year

- <8
- 8-10
- 10-12
- 12-14
- 14-16
- 16-18
- 18-20
- 20-24
- 24-28
- 28-32
- 32-36
- 36-40
- 40-44
- 44-48
- 48-52
- 52-56
- 56-60
- 60-70

Made in cooperation with Oregon State University

Data Sources: NOAA Cooperative Station Normals (1961-1990) climate observations. NRCS SNOTEL. Station normals and supplemental data provided by regional and state climatologists and designated reviewers

Digital Elevation Model: The PRISM DEM is derived from a 15-arc second Defense Mapping Agency (DMA) Digital Terrain Elevation Dataset (DTED) obtained from the EROS Data Center.

USDA-NRCS National Cartography & Geospatial Center, Fort Worth, TX, 1998

Estimation Technology: Gridded estimates were derived from station point values using the PRISM model developed at Oregon State University. The modeled grid was approximately 4x4 km latitude/longitude and was resampled to 2x2 km using a Gaussian filter.

Climate Dataset: April 1998 Albers Equal Area Projection, 96°W & 23°N, NAD 27

MILES

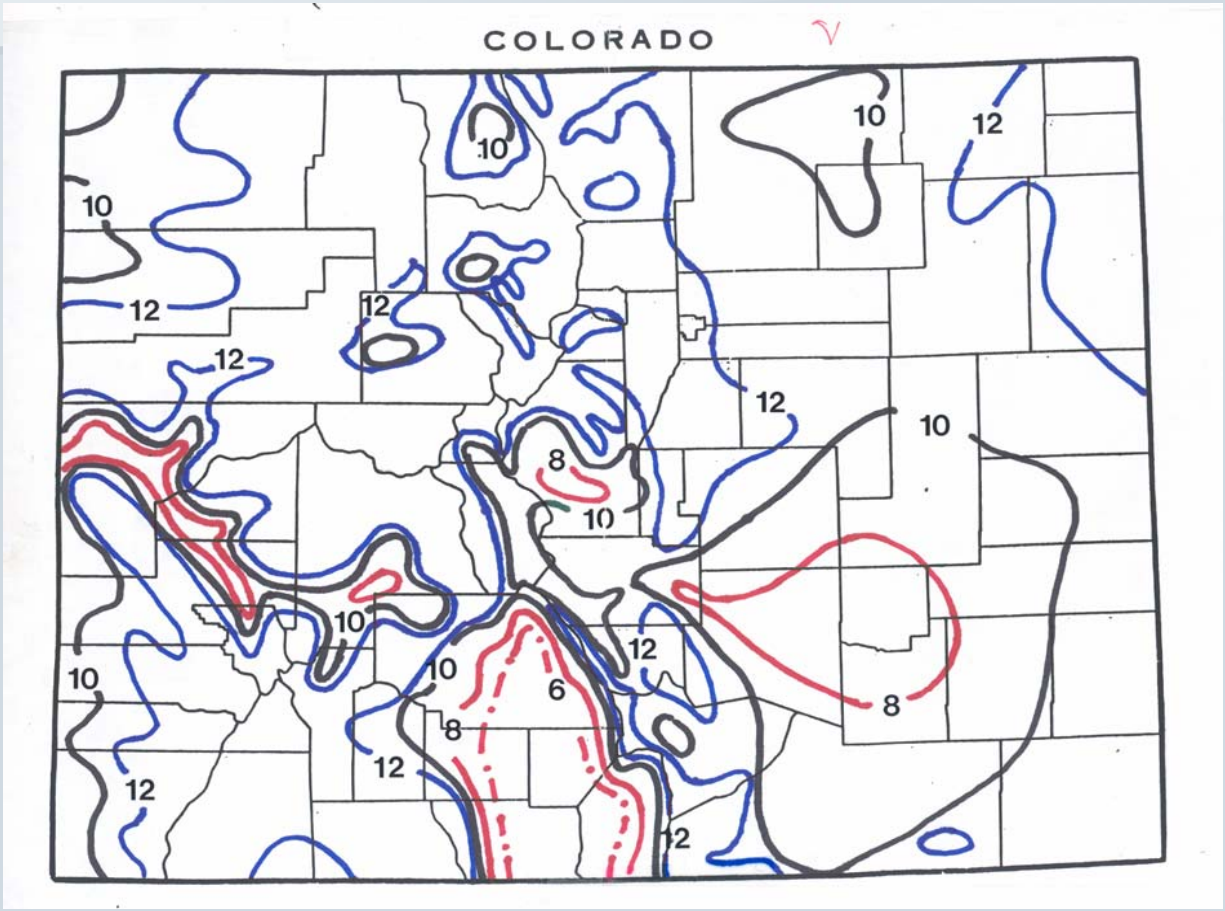
SCALE 1:1, 185, 000

SOURCE NOTE

Users are cautioned that contours may not exactly match station-observed precipitation especially in regions with significant precipitation gradients and/or steep topography

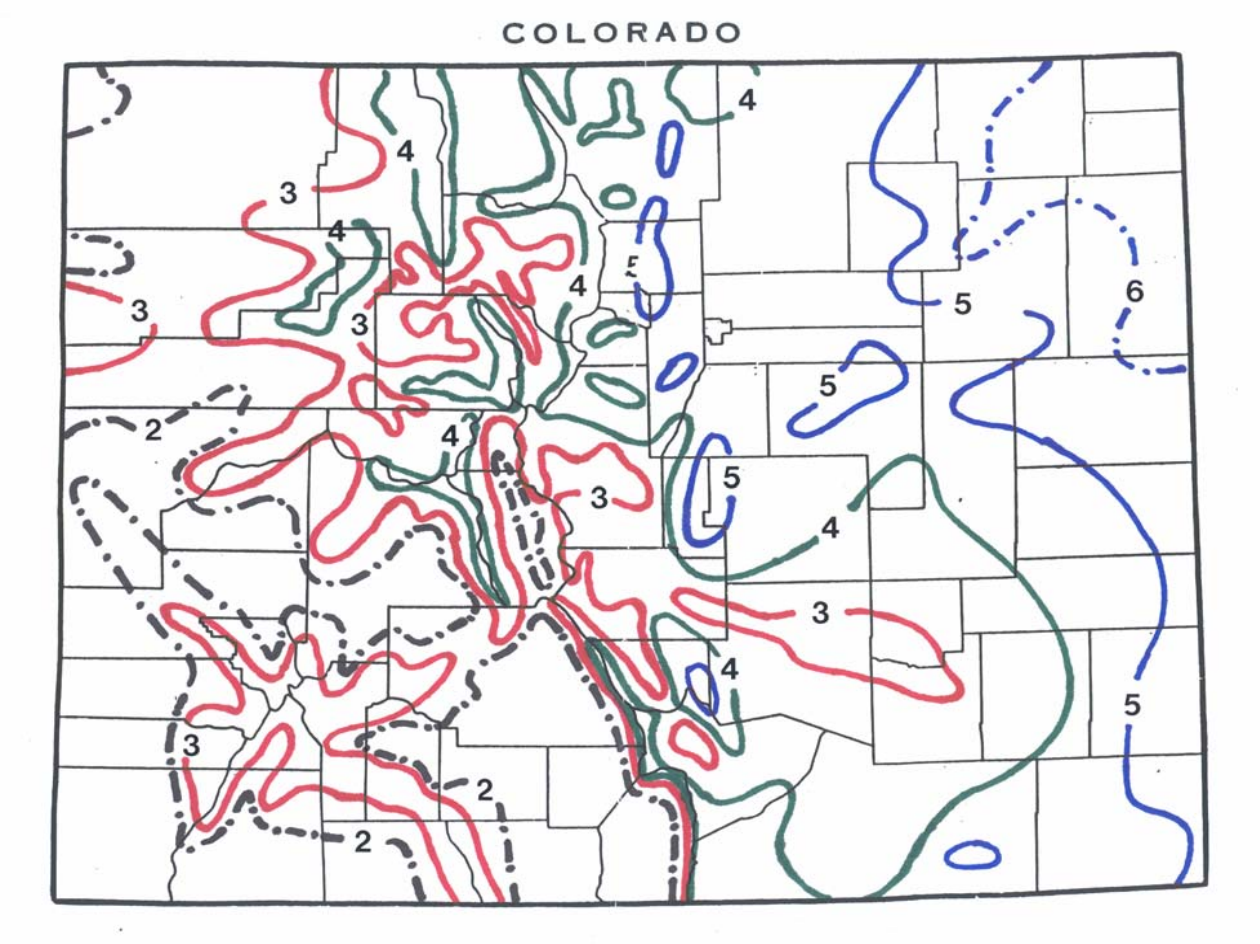
April 1998 1009496

Average Wheat-Season Precipitation
September – June (Inches)
(Based on 1961-90 observed data)

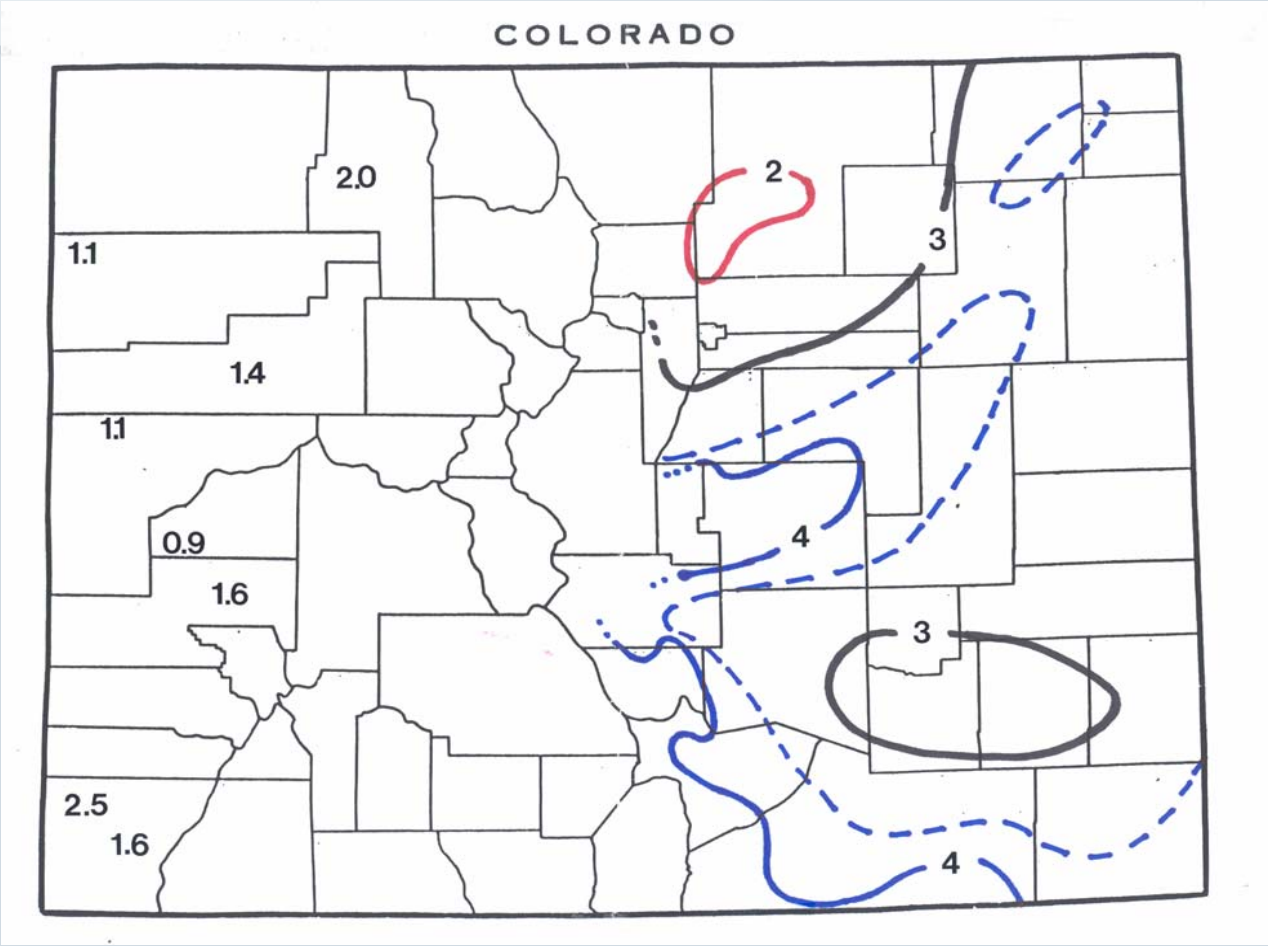


Provided by the Colorado Climate Center

Average May-June Precipitation (Inches) (Based on 1961-90 observed data)



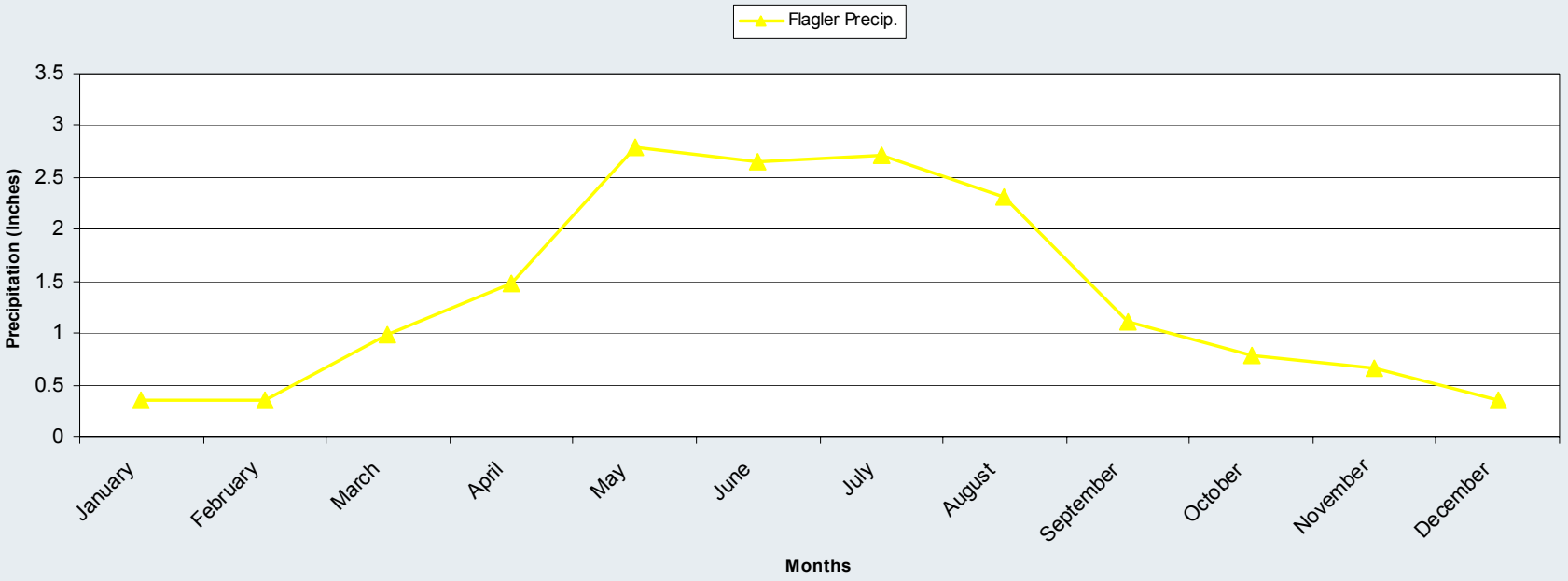
Average Precipitation (Inches)
For the Period 15 July – 25 August
(Based on 1961-1990 observed data)

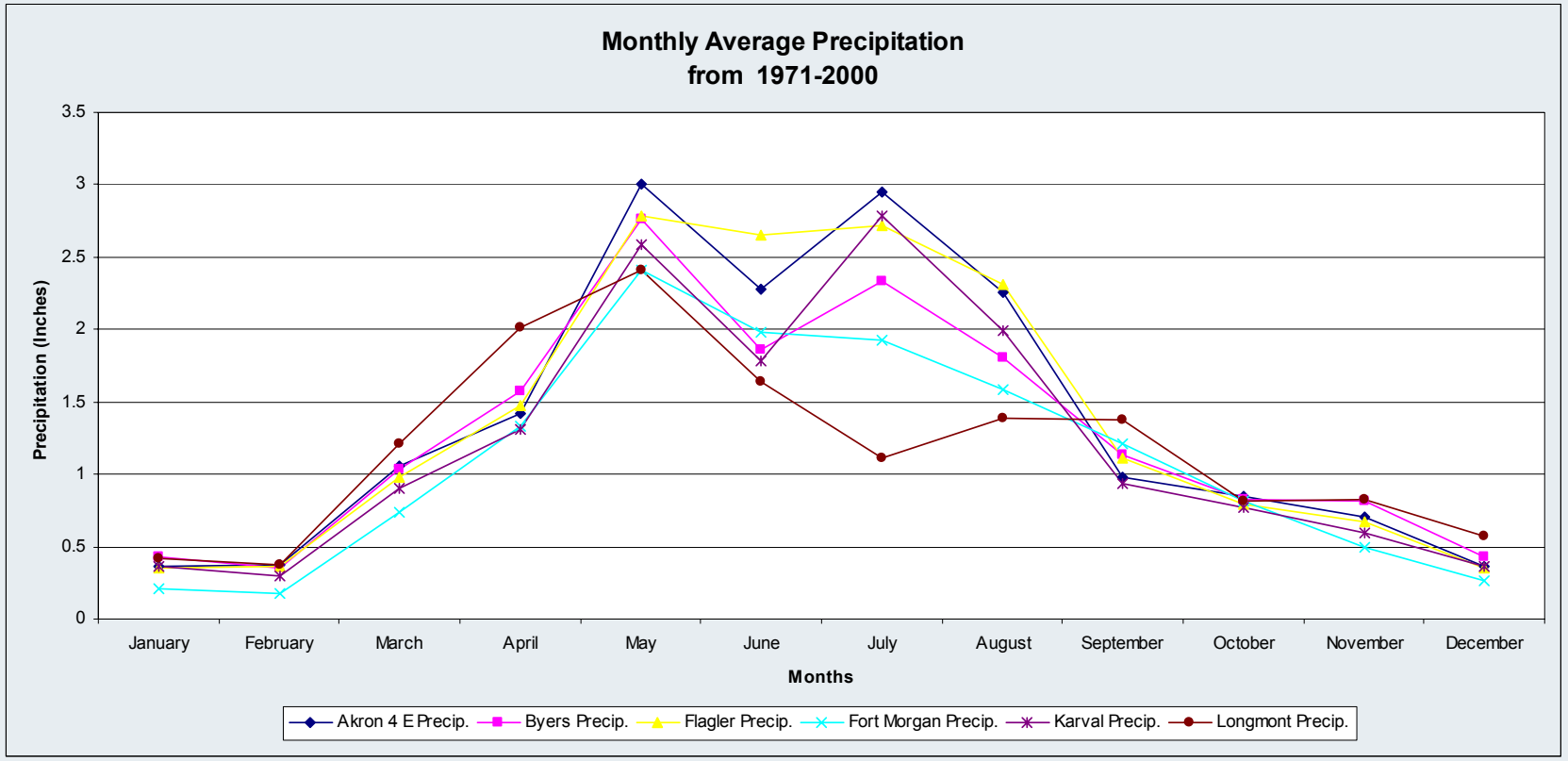


Precipitation

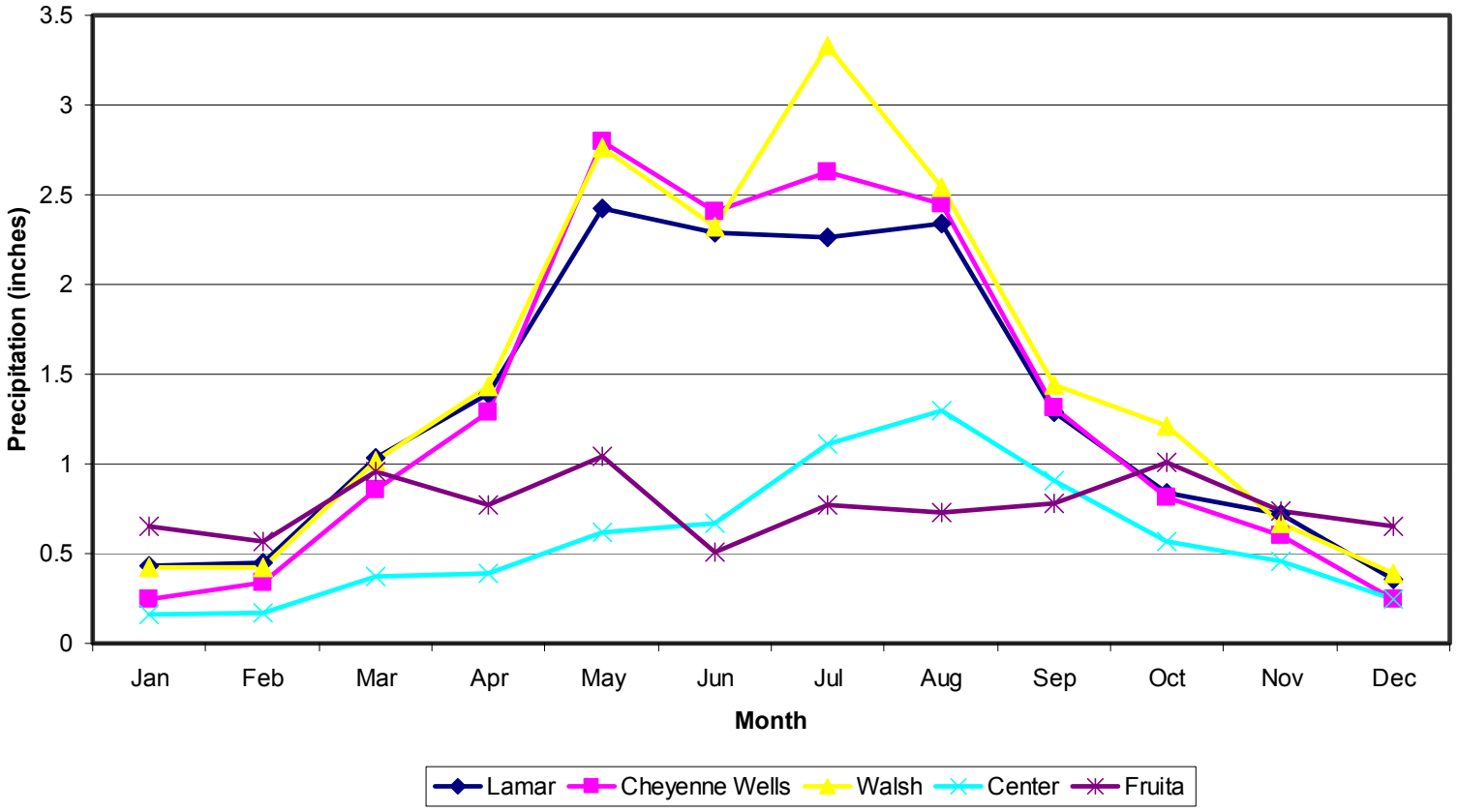
- Highly seasonal, but seasonal pattern varies with topography
  - High mountains wet in winter-spring and again in later summer
  - Foothills and eastern plains very dry in winter, wet in spring and early summer

Flagler
Monthly Average Precipitation
from 1971-2000




Monthly Average Precipitation
from 1971-2000
Precipitation (Inches)
3.5
3
2.5
2
1.5
1
0.5
0
January
February
March
April
May
June
July
August
September
October
November
December
Months
Akron 4 E Precip.
Byers Precip.
Flagler Precip.
Fort Morgan Precip.
Karval Precip.
Longmont Precip.

Monthly Average Precipitation for 1971-2000

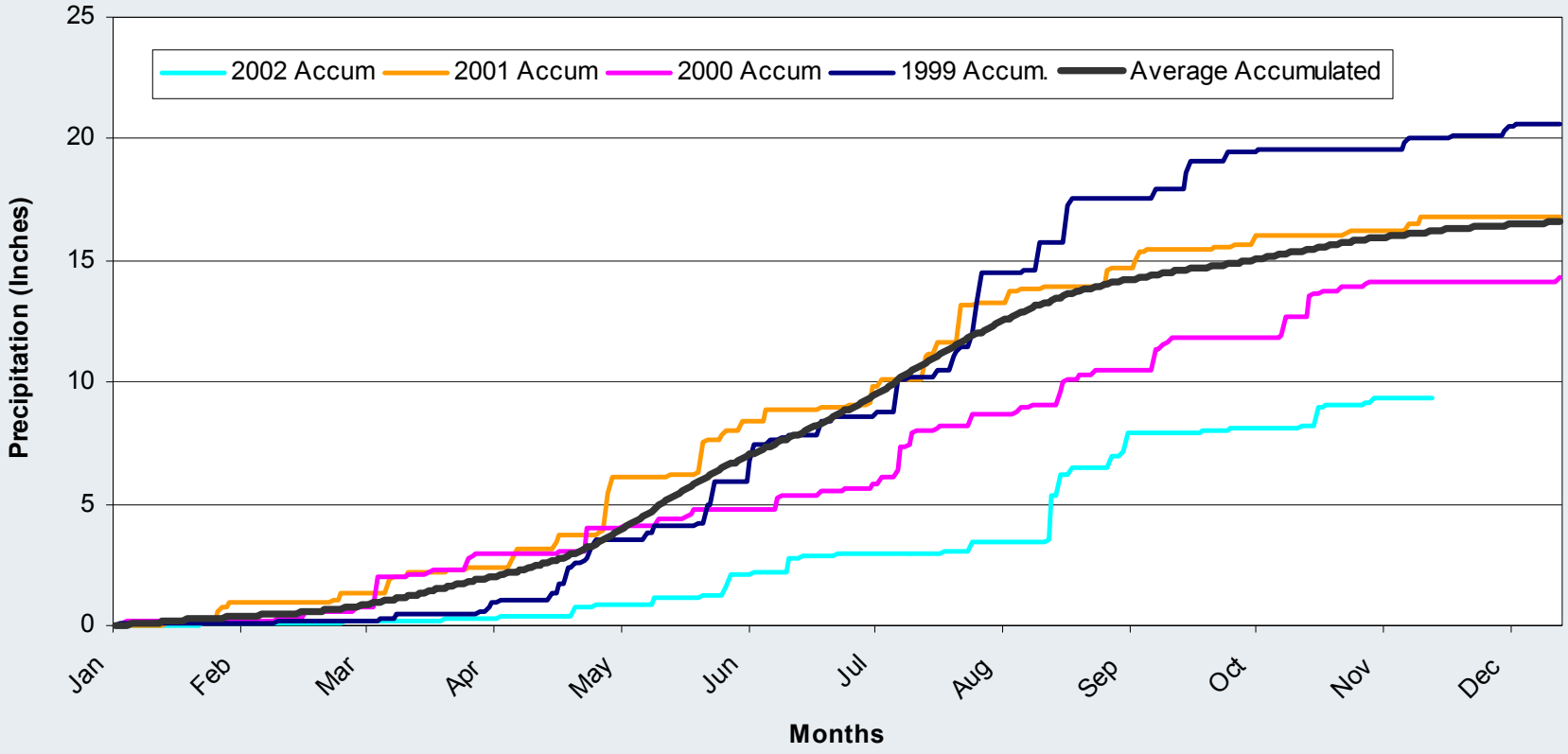


Precipitation

- A few storms contribute a large fraction of annual precipitation while many small events contribute a small fraction

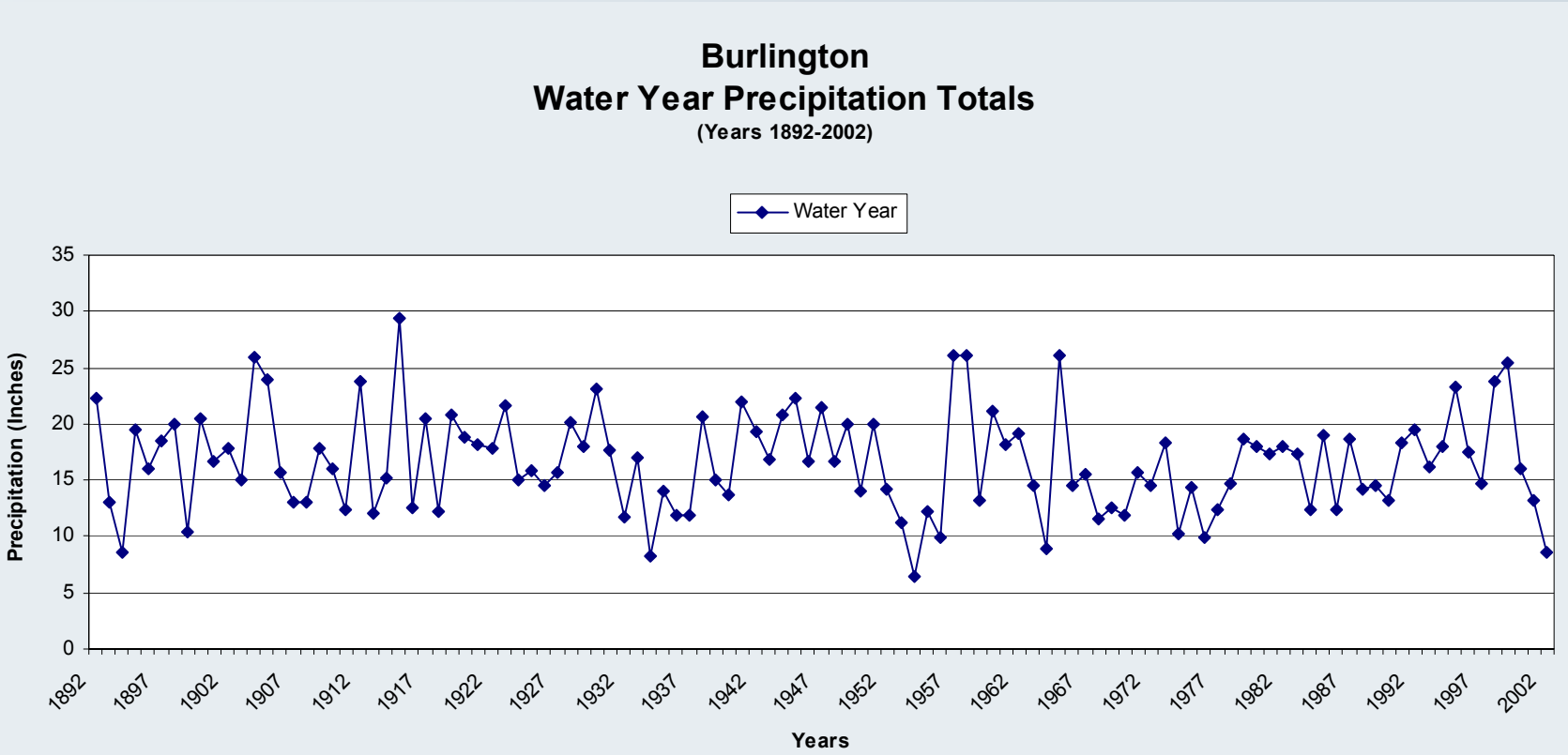
Akron 4-E

Daily Accumulated Precipitation for
Years 1999, 2000, 2001, 2002 (thru Nov.02) and 30 Year Average

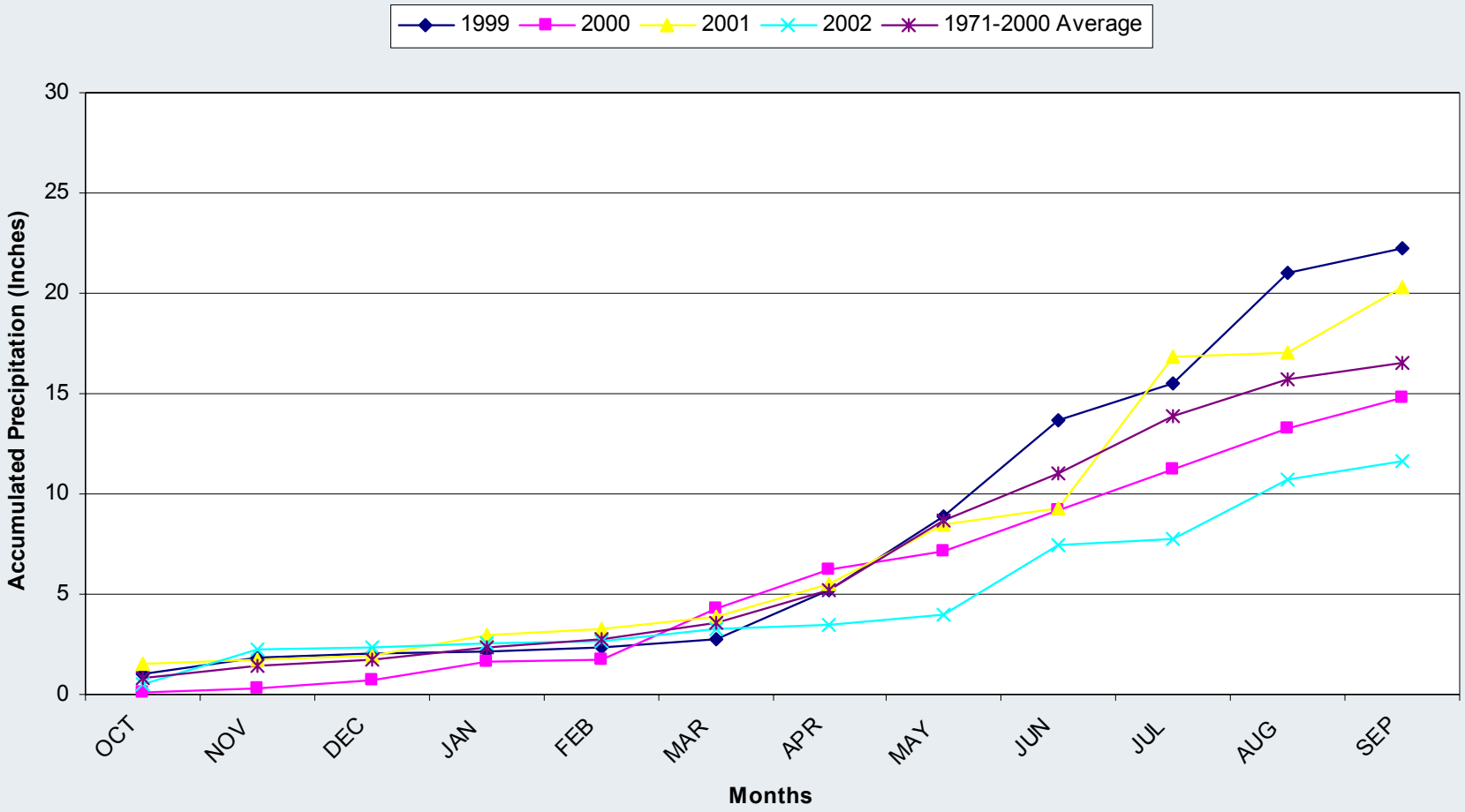


Precipitation

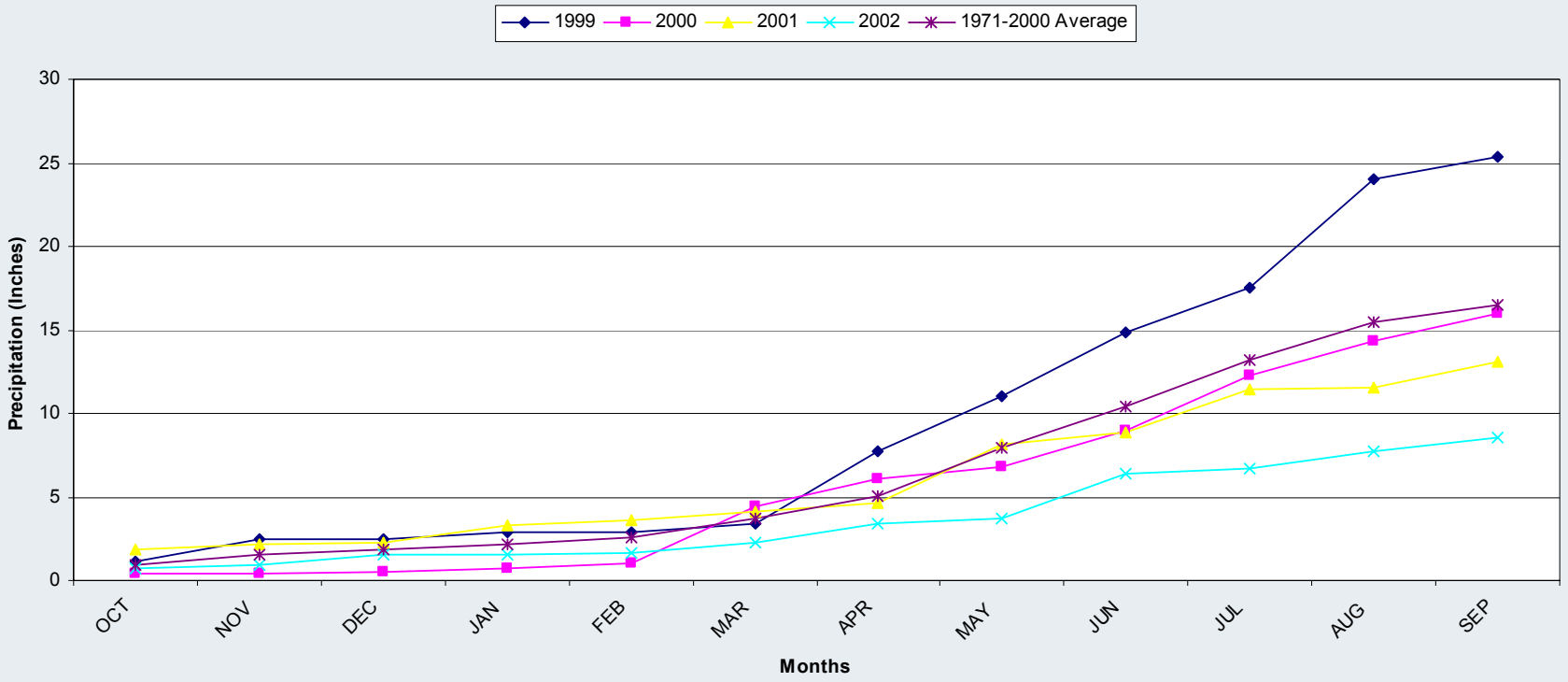
- No two years are ever the same.
- Annual precipitation varies greatly from year to year.


Burlington
Water Year Precipitation Totals
(Years 1892-2002)
Water Year
Precipitation (Inches)
0
5
10
15
20
25
30
35
1892
1897
1902
1907
1912
1917
1922
1927
1932
1937
1942
1947
1952
1957
1962
1967
1972
1977
1982
1987
1992
1997
2002
Years

Joes
Water Year Accumulated Precipitation
(1999-2002 and 30 Year Average)



Burlington
Water Year Accumulated Precipitation
(1999-2002 and 30 Year Average)



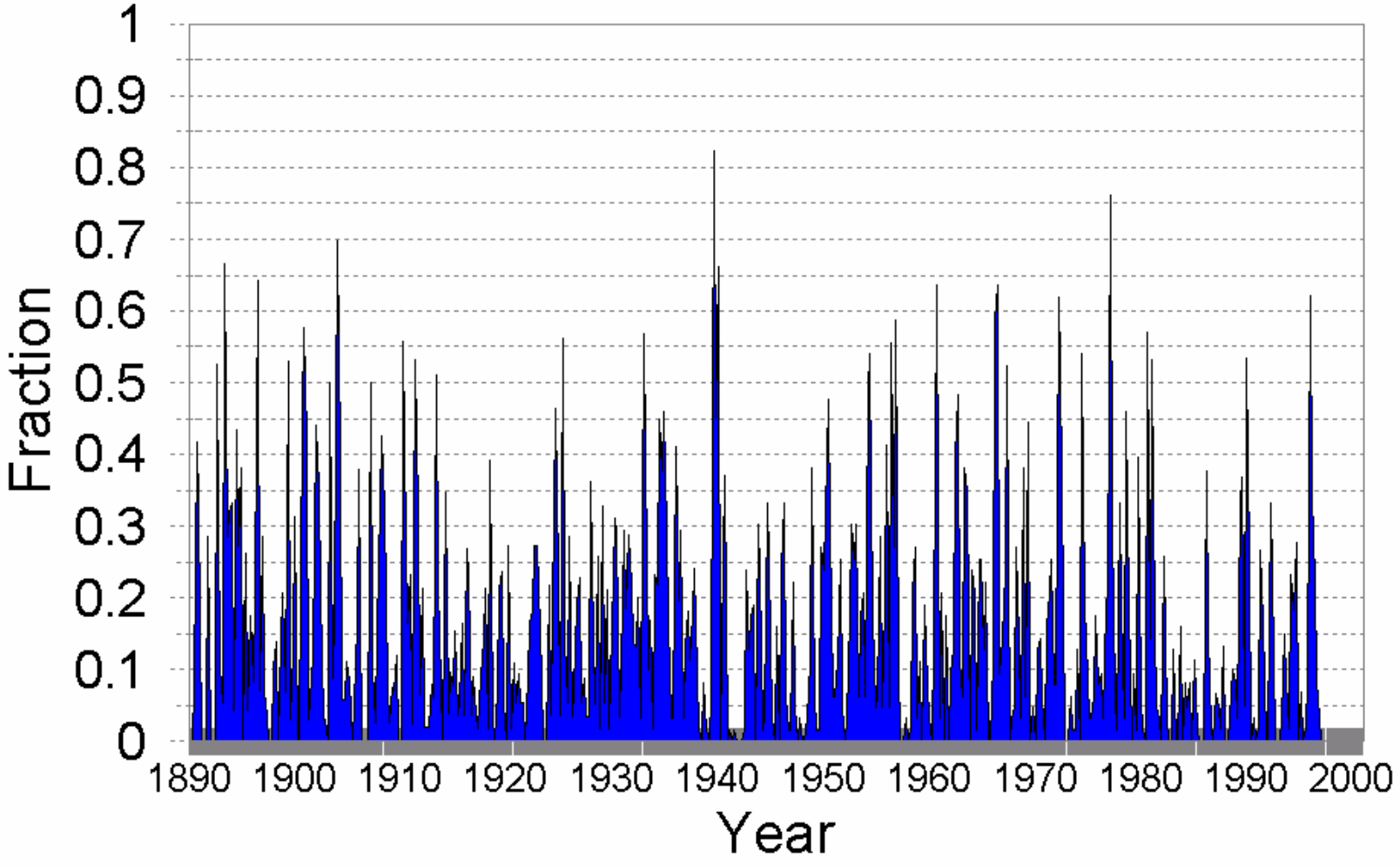
The Colorado Drought of 2002 in Perspective

Known Characteristics of Drought

- Drought teases Colorado often
- Some portion of the state is in drought, based on common definitions and popular drought indices in at least 9 out of every 10 years

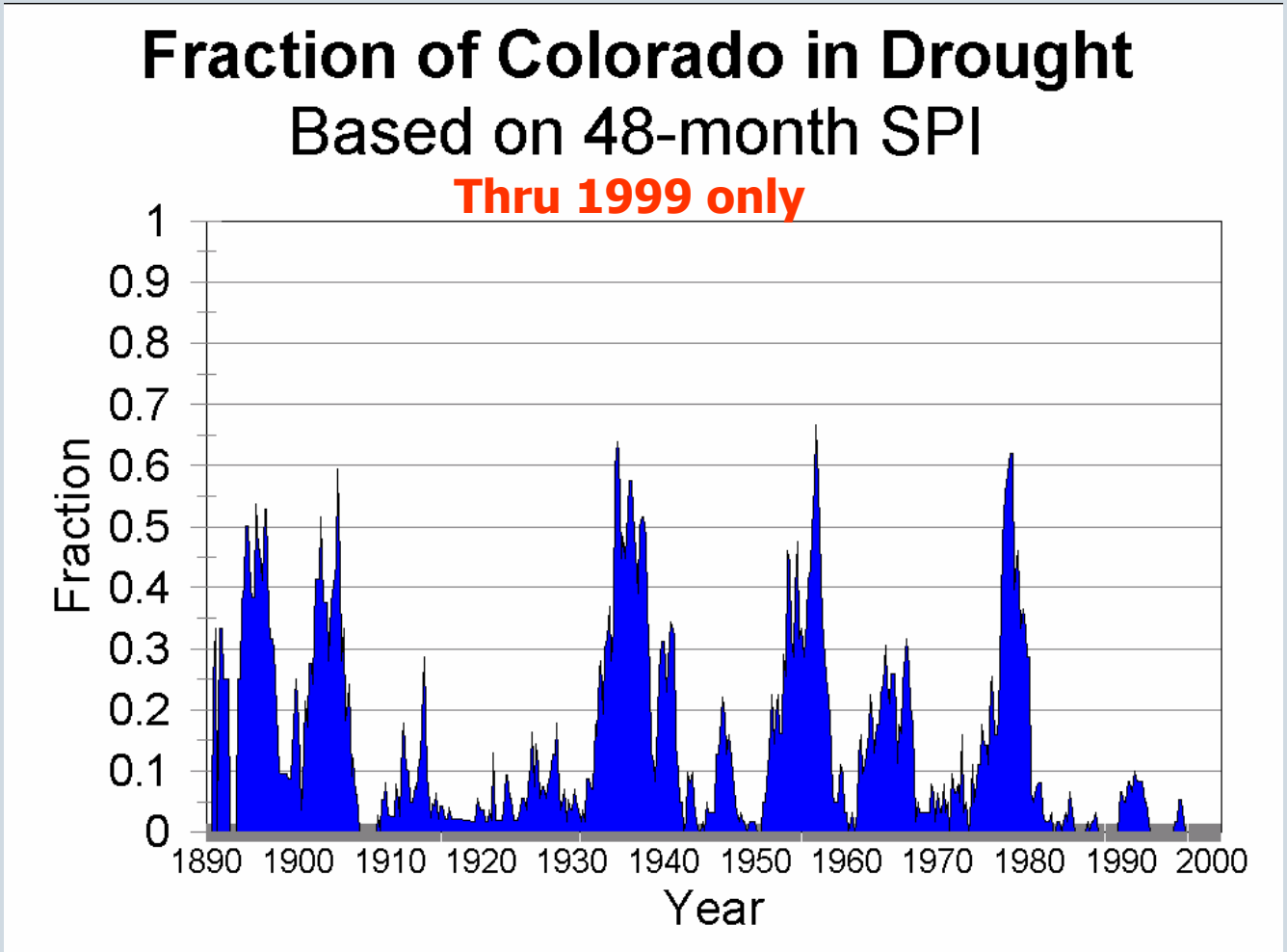
Fraction of Colorado in Drought

Based on 3-month SPI



Severe Drought Occurrences

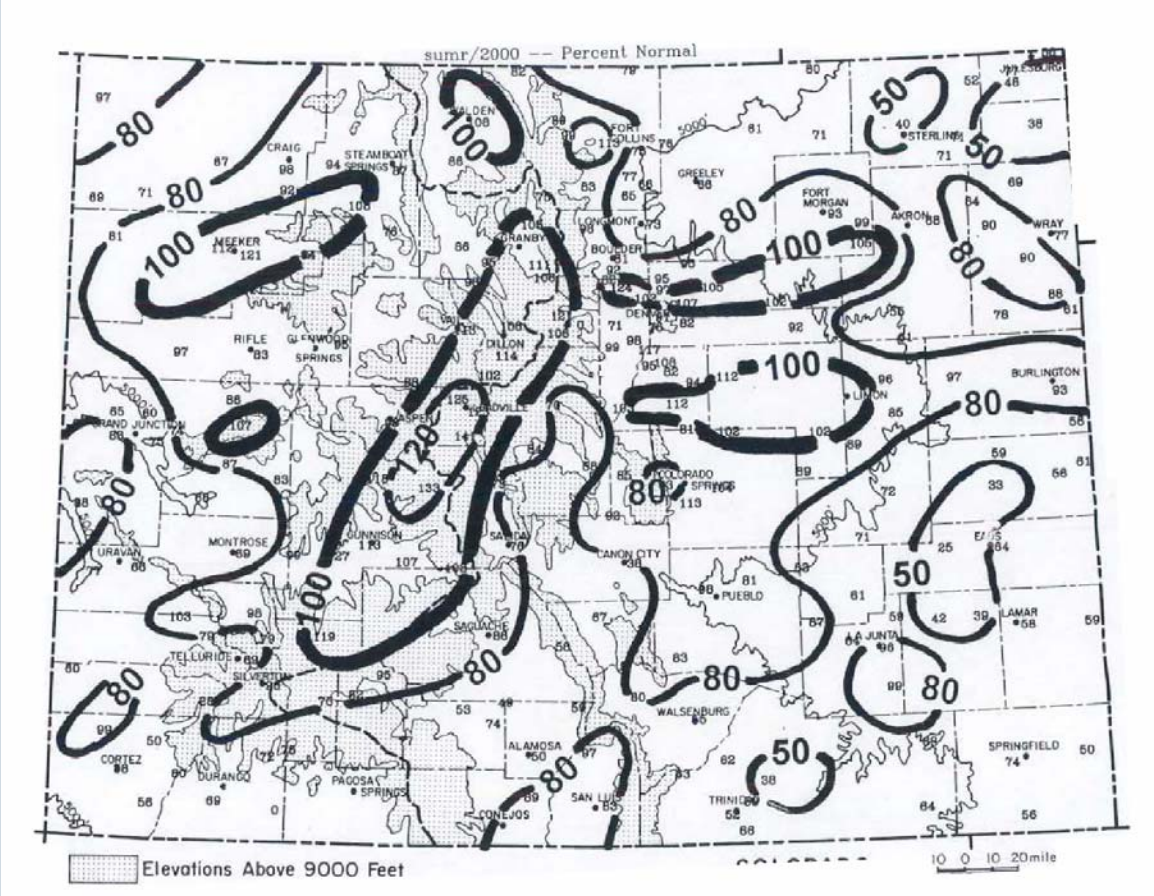
- **Severe multi-year and widespread droughts occur a few times per century as evidenced by precipitation and stream flow records back into the 1880s, but also centuries farther back in history as revealed by tree rings and other "paleo" indicators.**



2000 Growing Season

- The months of April - June 2000 were very dry and hot.
- Sedgwick and Phillips counties were especially hard hit, and agricultural impacts were severe.
- Some later summer moisture did fall that helped dryland agriculture.
- Range and pasture conditions deteriorated steadily
- Entire summer was warmer than average -- the warmest summer in many years.
- Some severe ag. Impacts in Eastern Colo.

Growing Season Precipitation as a % of Average

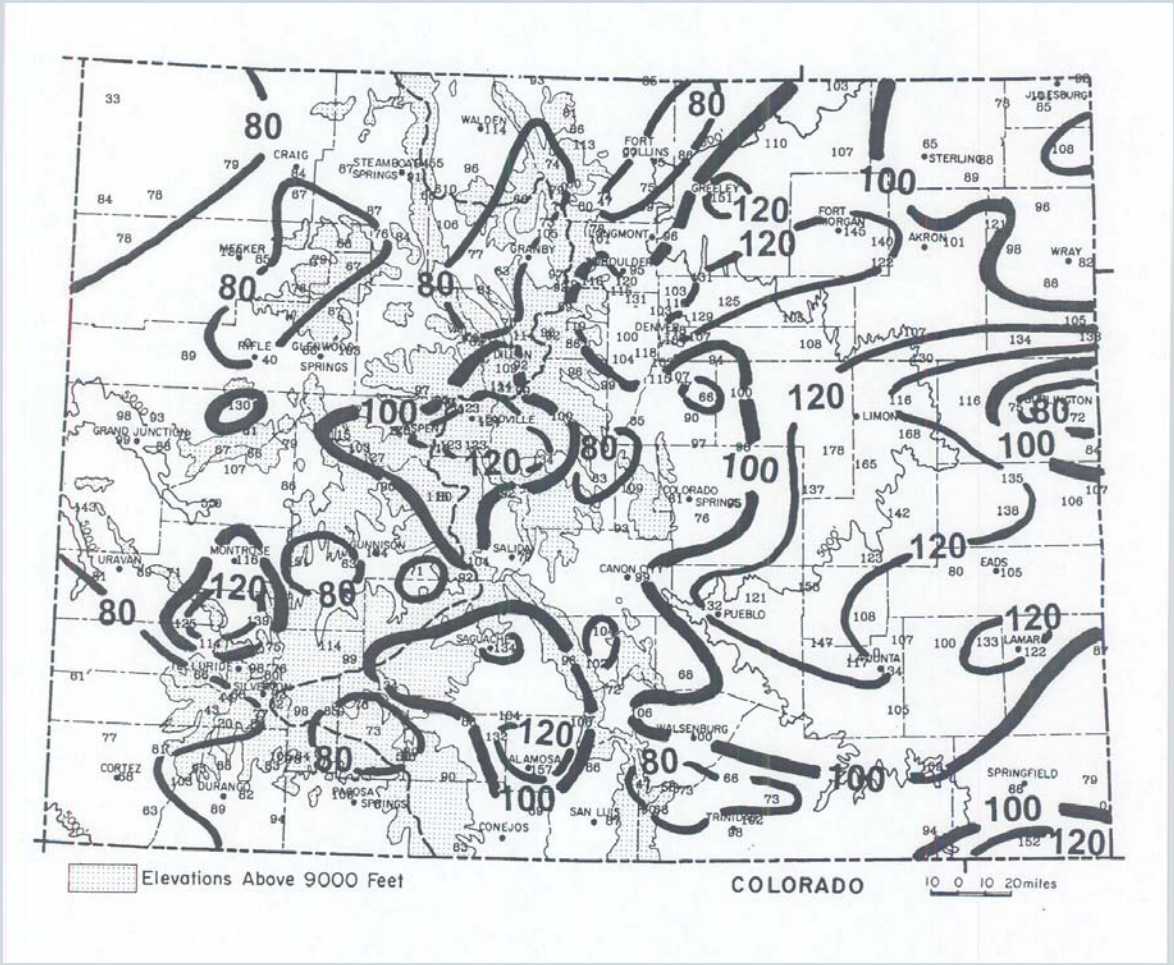


Summer of 2001

- Decent but spotty rains
- Another hot summer
- 2nd year in a row with high evaporation rates

2001 May-Sept. Precipitation as % of Average

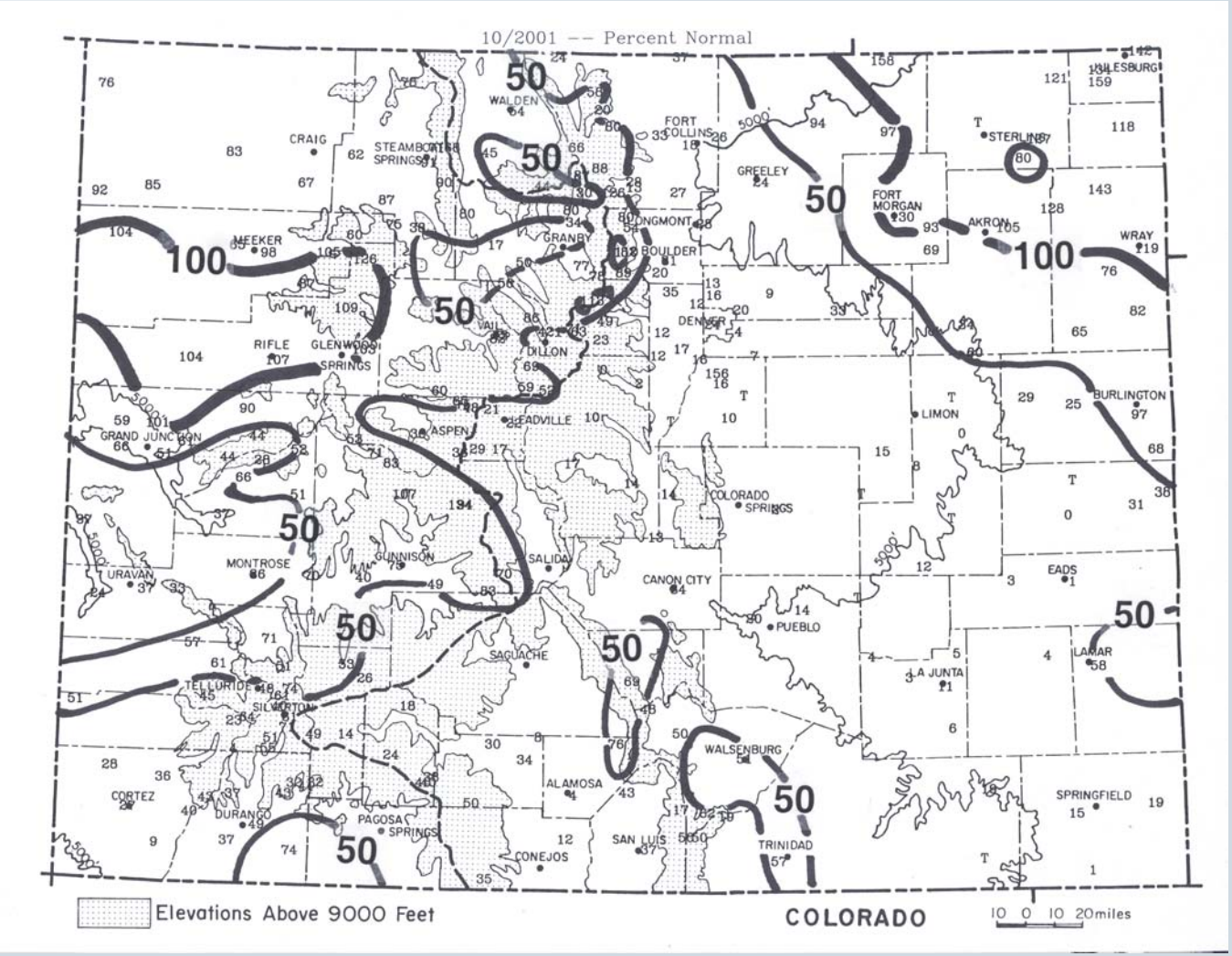
- Good moisture in most of Plains
- Dry much mountain and Western Slope



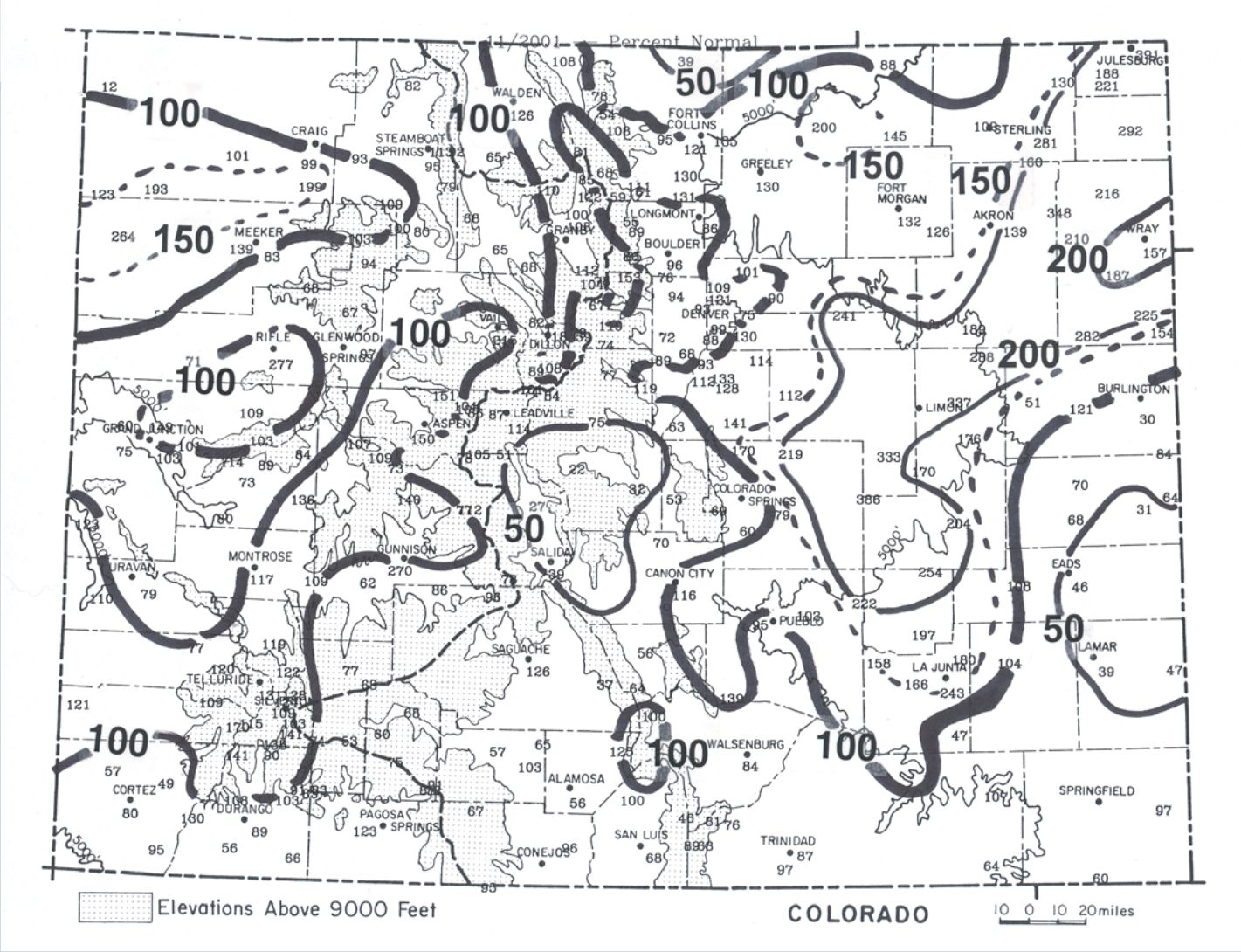
The 2002 Drought

- Monthly evolution
  - By the end of 2001 Water Year soils were dry and reservoirs down to 93% of average (statewide)

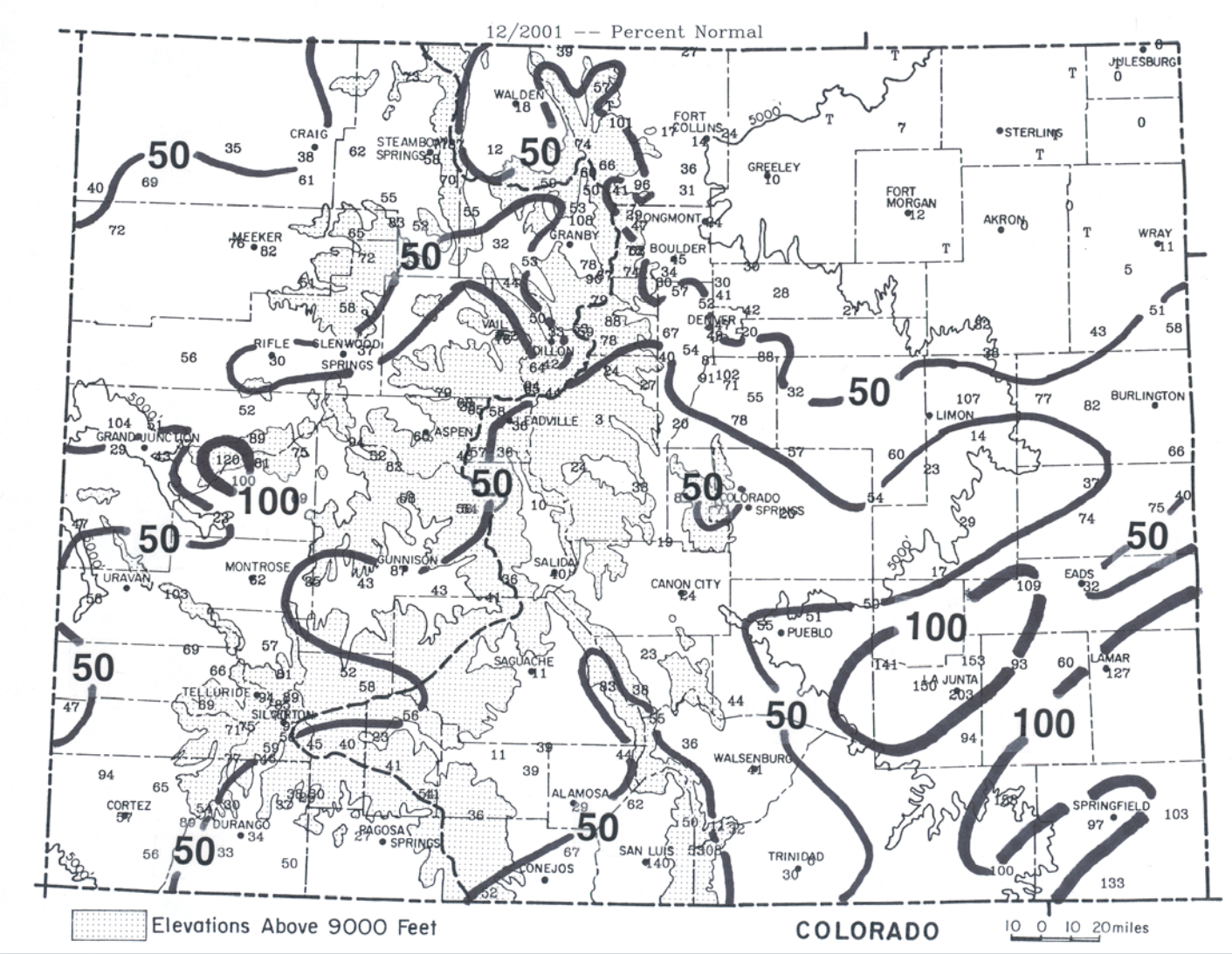
October 2001 % of Average



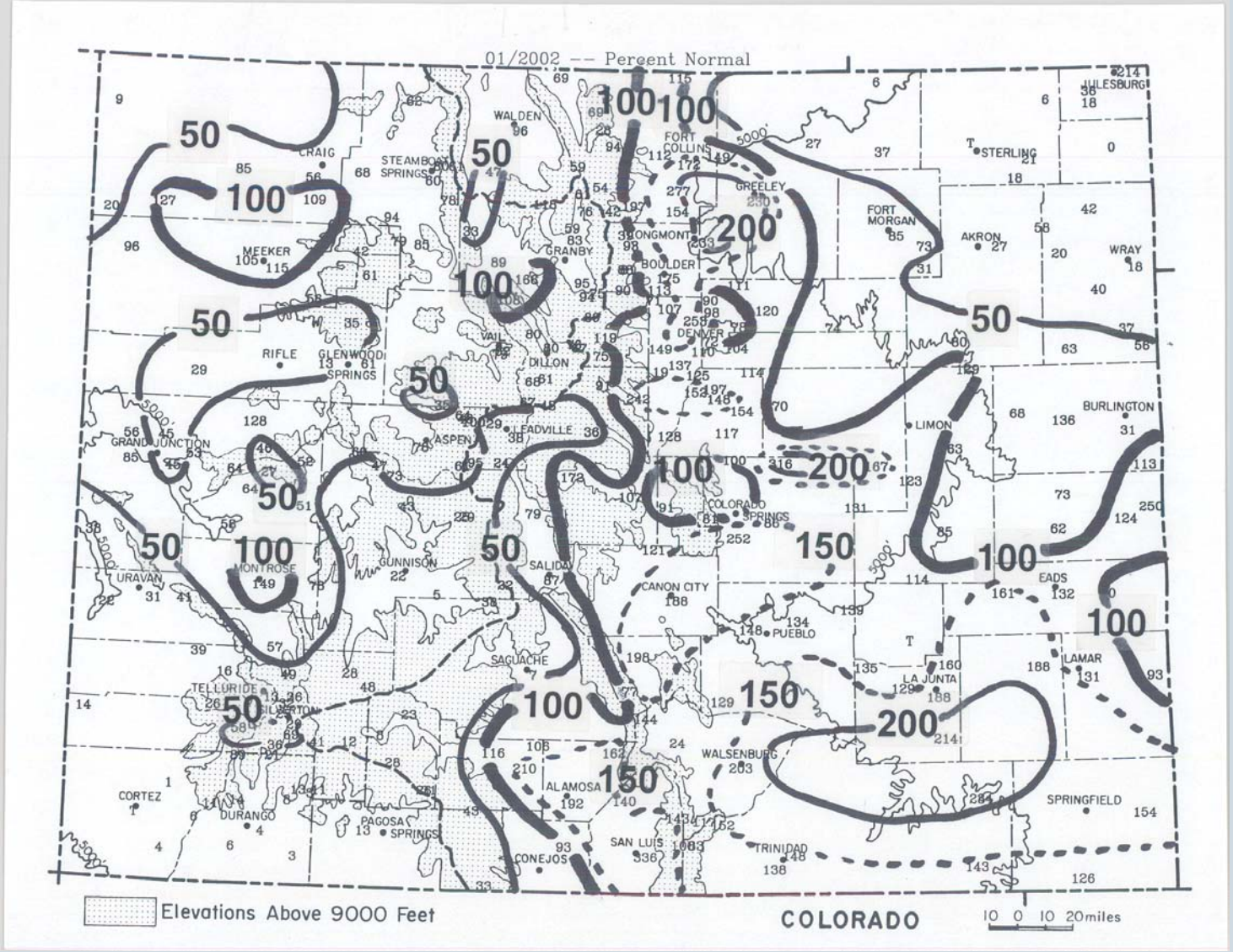
November 2001 % of Average



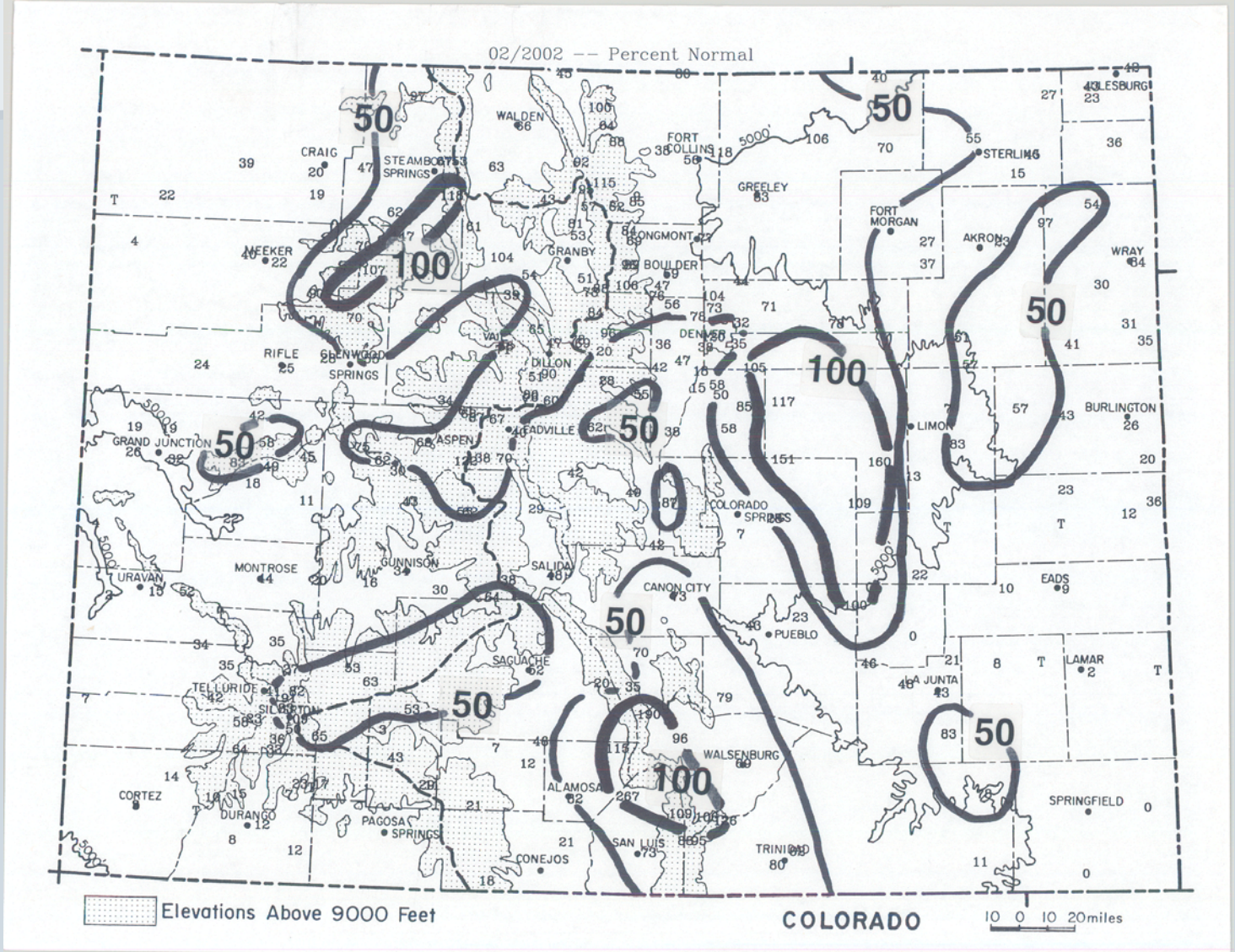
December 2001 % of Average



January 2002 % of Average

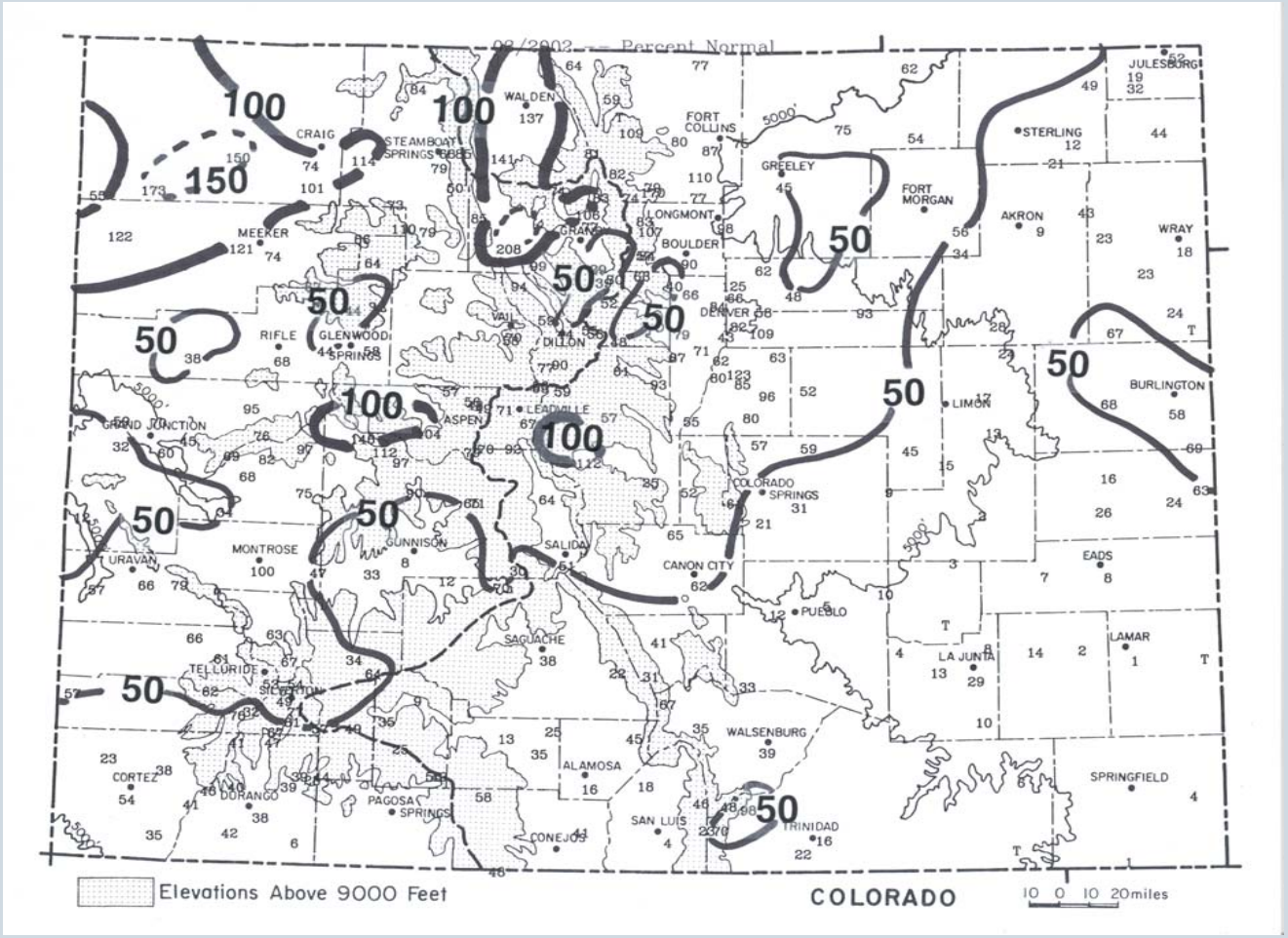


February 2002 % of Average



March 2002 % of Average

- March was very dry but cold tempera-ture made it seem less "droughty"



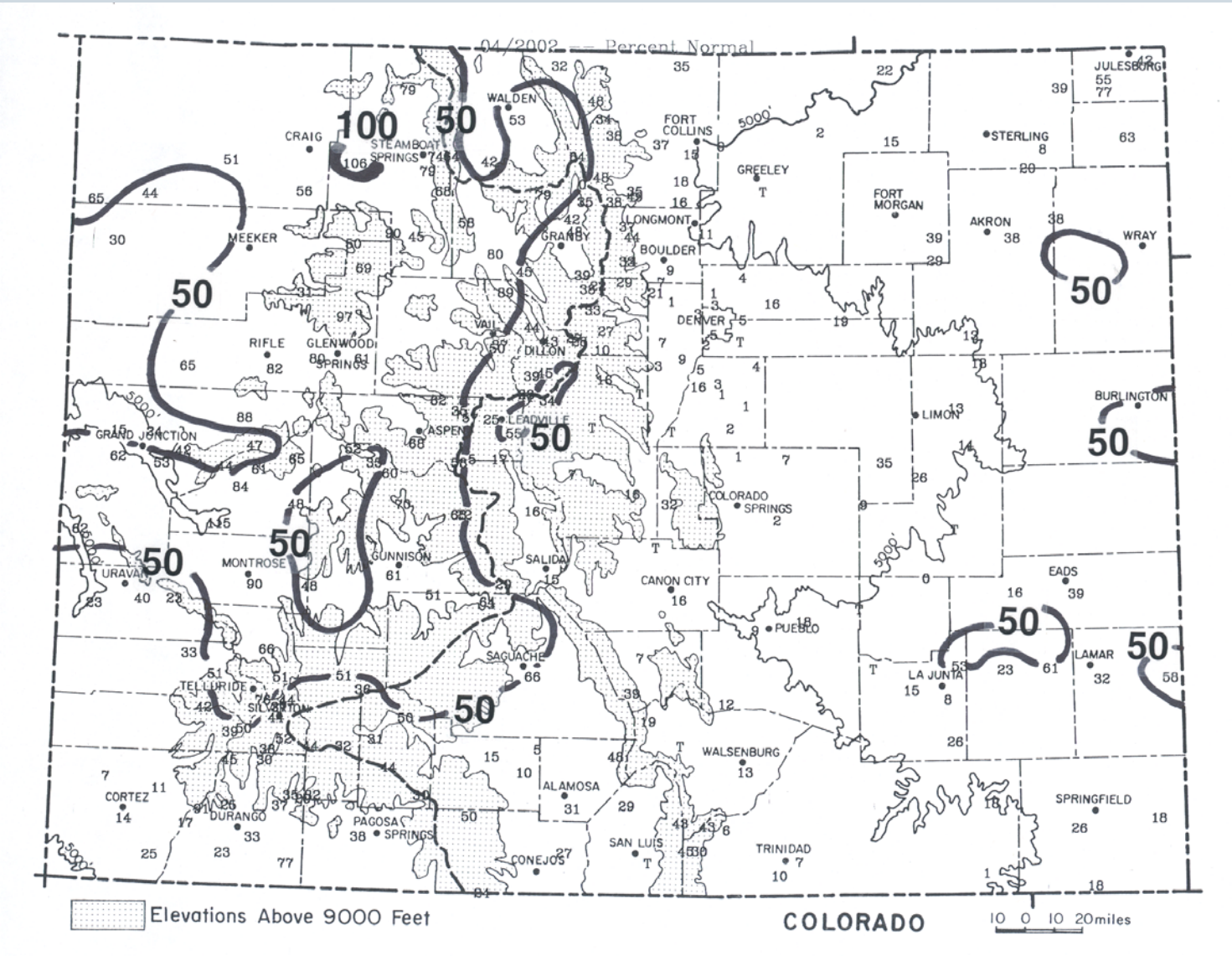
Drought Status on April 1, 2002

- Entire State Dry
- Statewide Snowpack
  - 53% of Average
- Bad, but not as bad as 1977
- Optimism for a wet spring – especially in Northern Colorado

But then came April

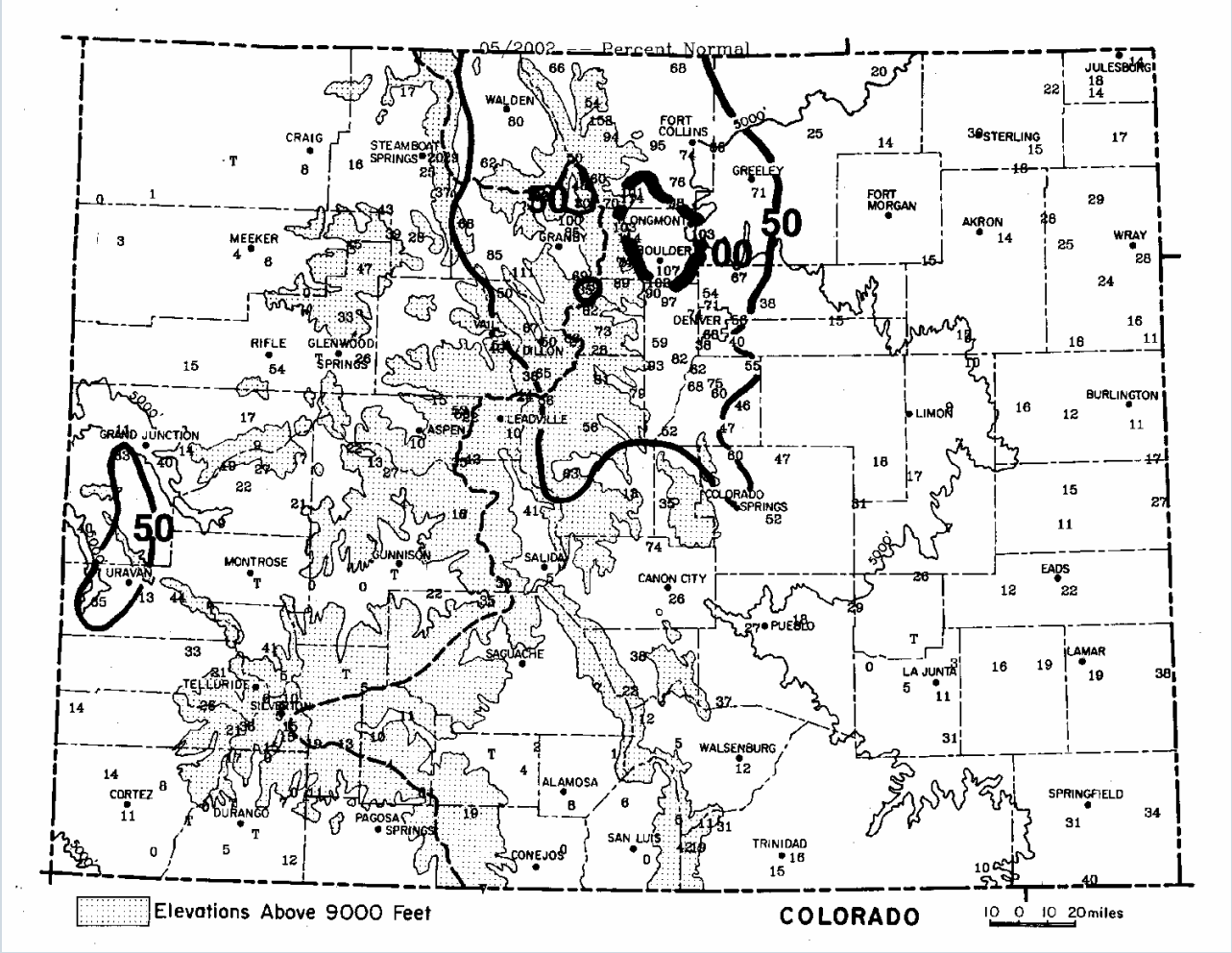
- Very warm – especially in Mountains
- Very Dry
- Rapid Snowmelt
- Little Runoff

April 2002 % of Average

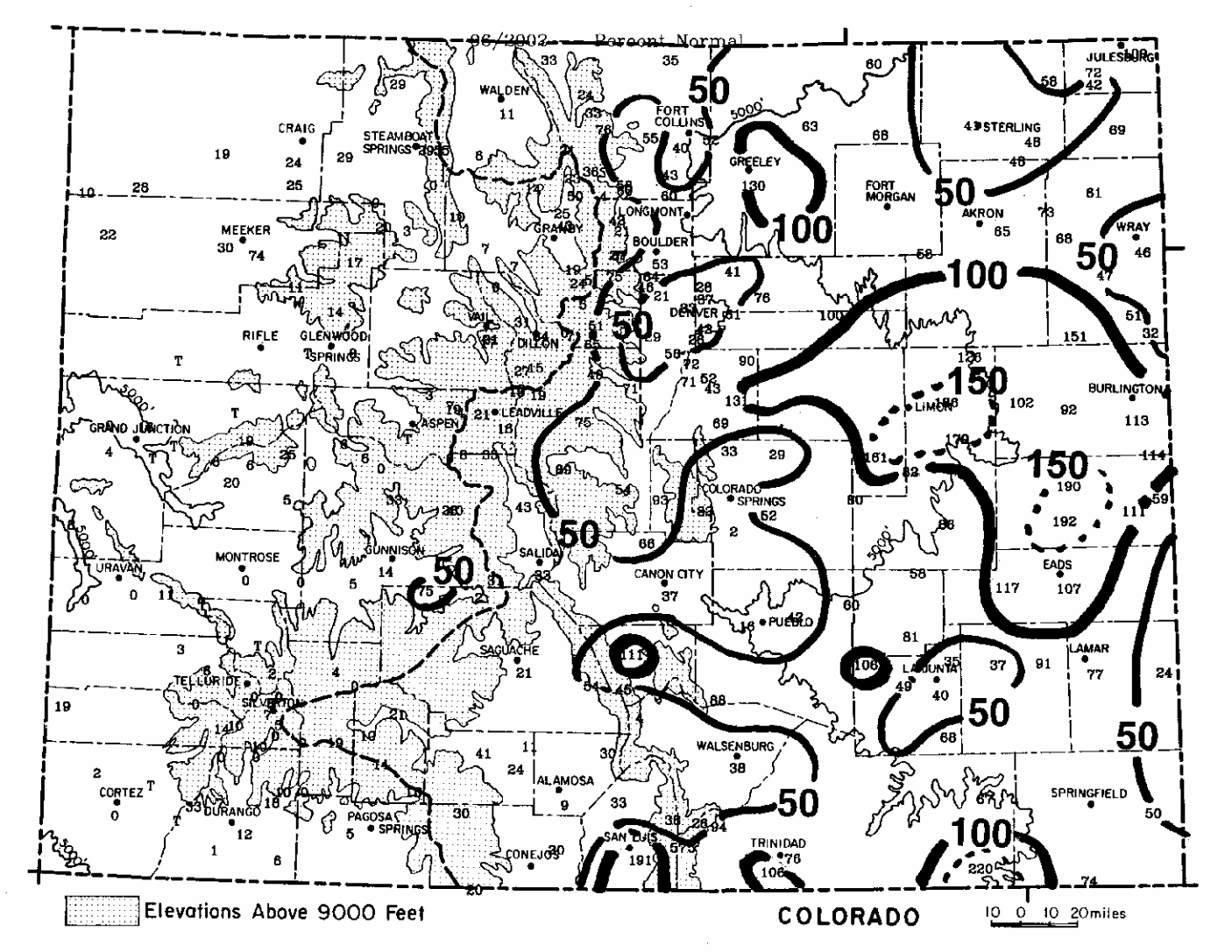


May 2002 also failed us

- Only one significant storm
- High evaporation rates
- Severe drought arrived !!



June 2002 % of Average

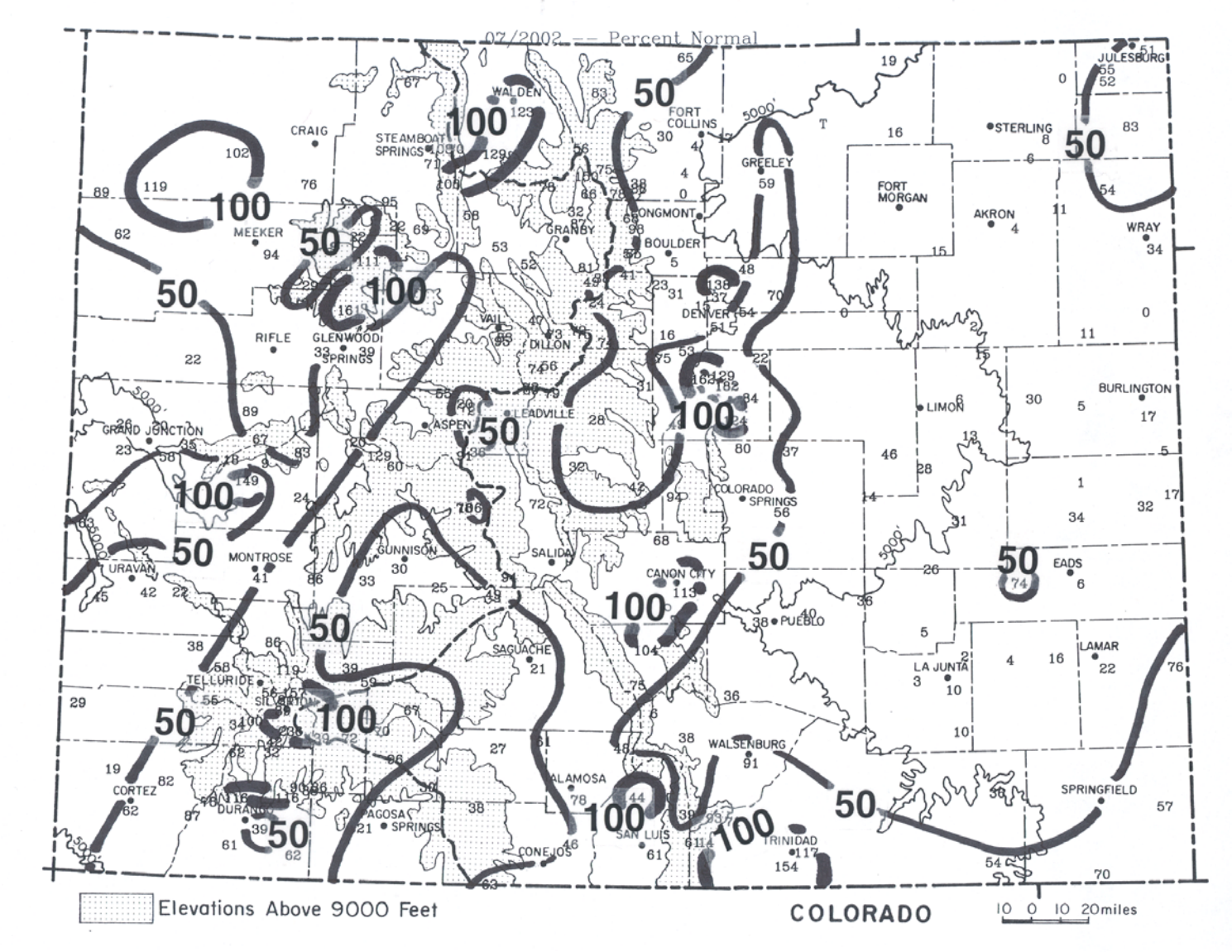


By late June 2002

- Raging wildfires
- Extreme low streamflows
- Rapidly depleted reservoirs
- Severe agricultural impacts
  - Wheat
  - Cattle
  - Irrigated crops in jeopardy
- Intense heat
- Urban water restrictions

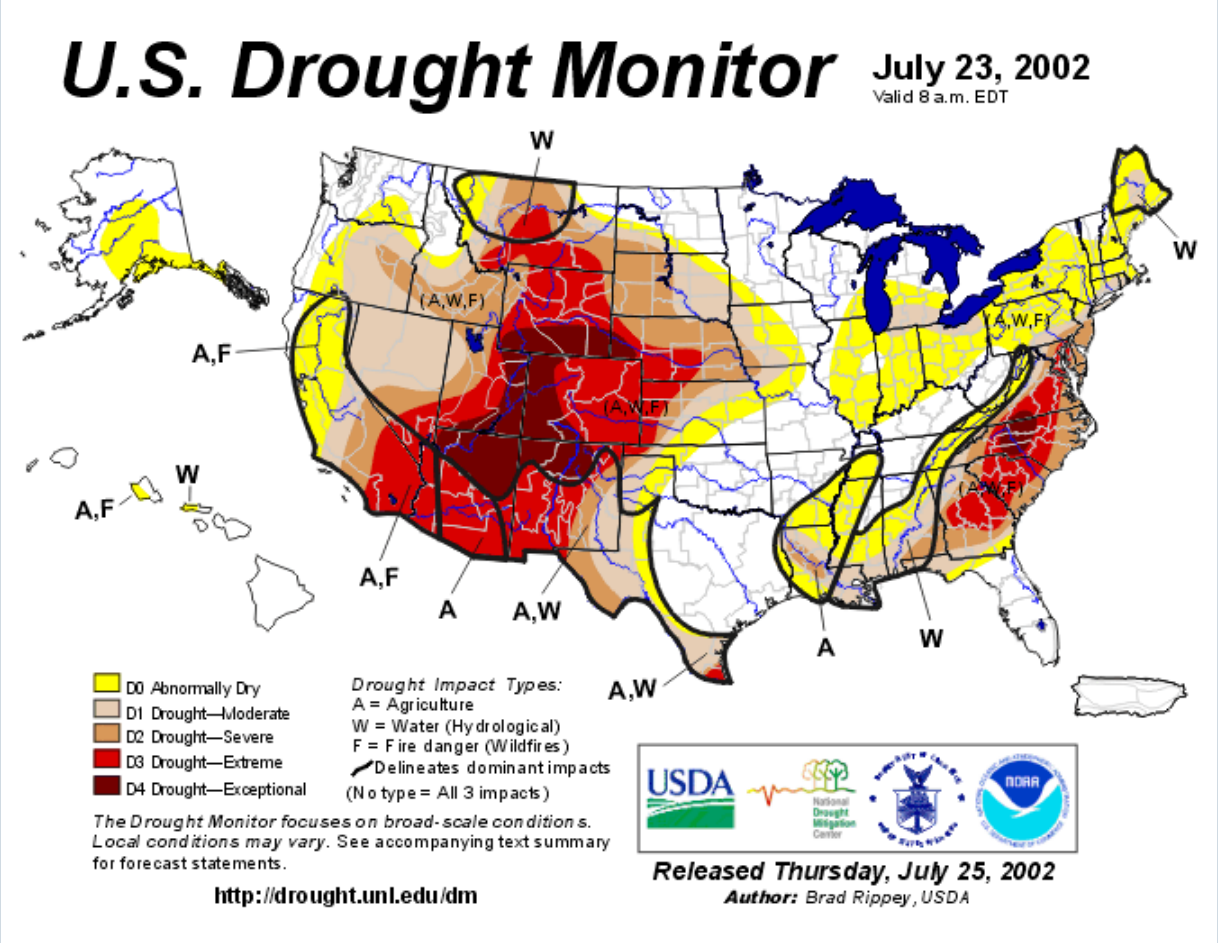
Hayman Fire
Largest in Recent History

July 2002 % of Average



Widespread Drought

- By late July 2002, Colorado near epicenter of extensive regional drought
- Parts of nearly every state experiencing drought

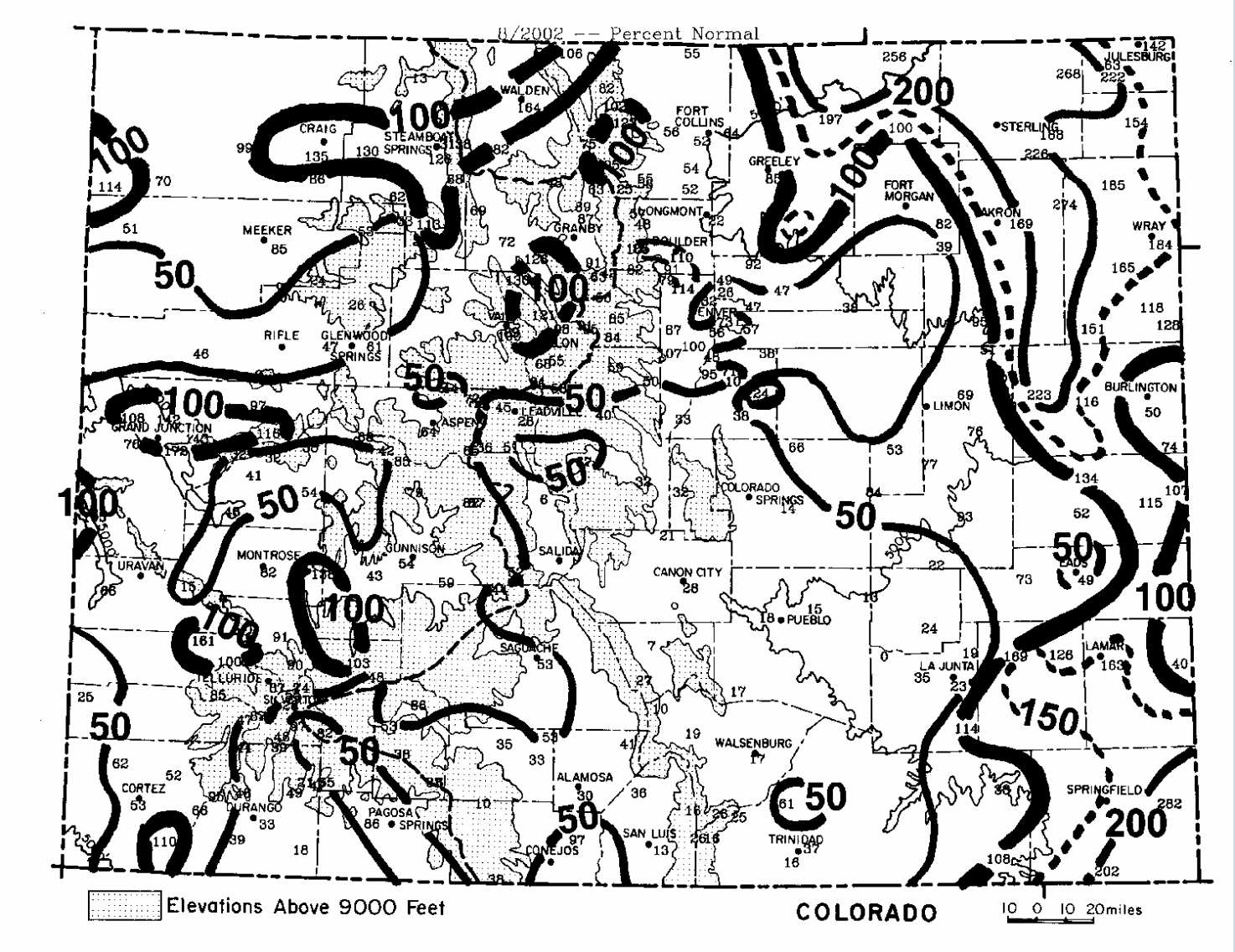


August 2002 Pattern Changes

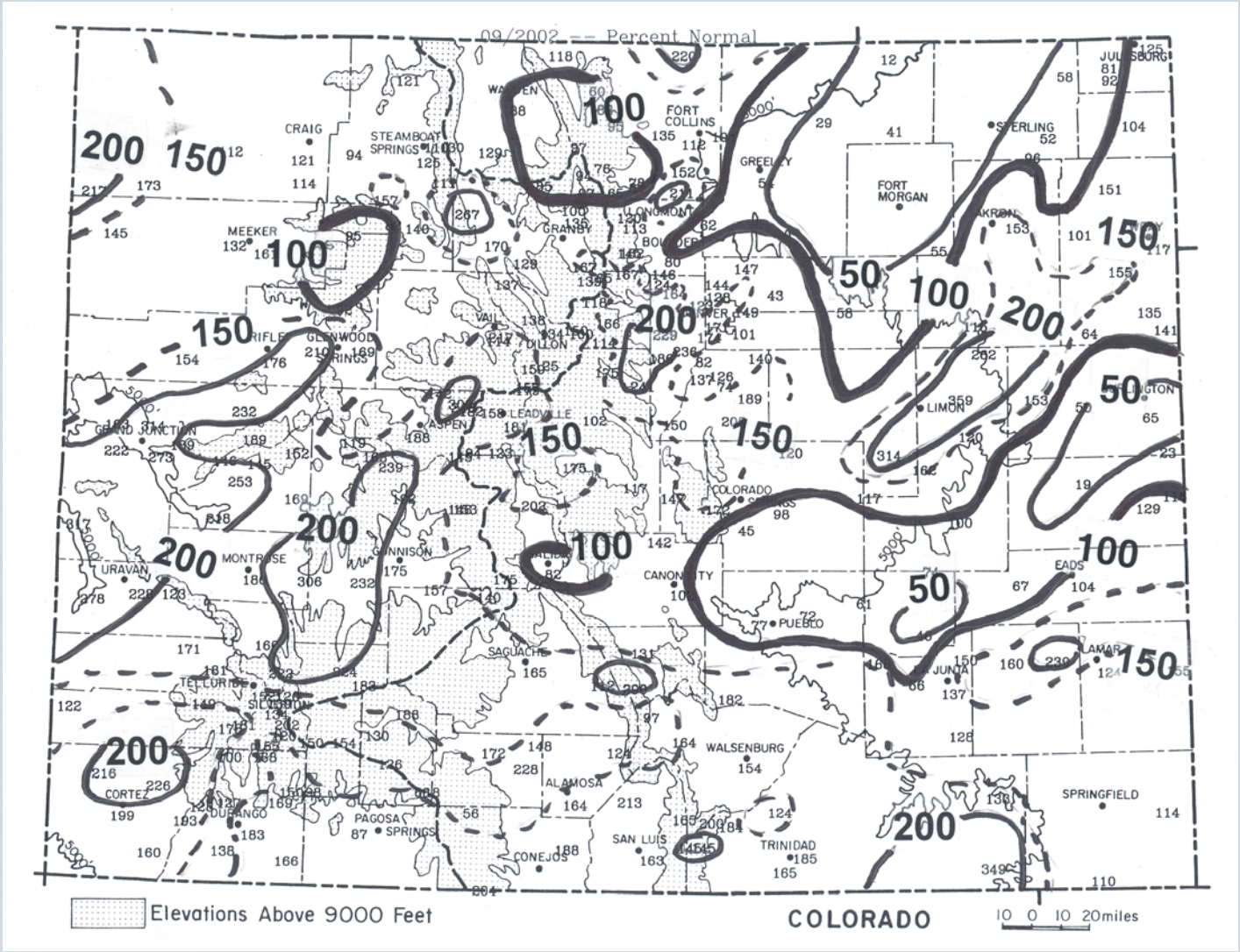
- More extreme heat early
- Another wildfire flare up
- Severe storms late in August
- Real relief in portions of the Eastern Plains
- But most of Colorado still in extreme drought

Steamboat Springs Fire
Photo from Steamboat Springs Fire Department

August 2002 % of Average



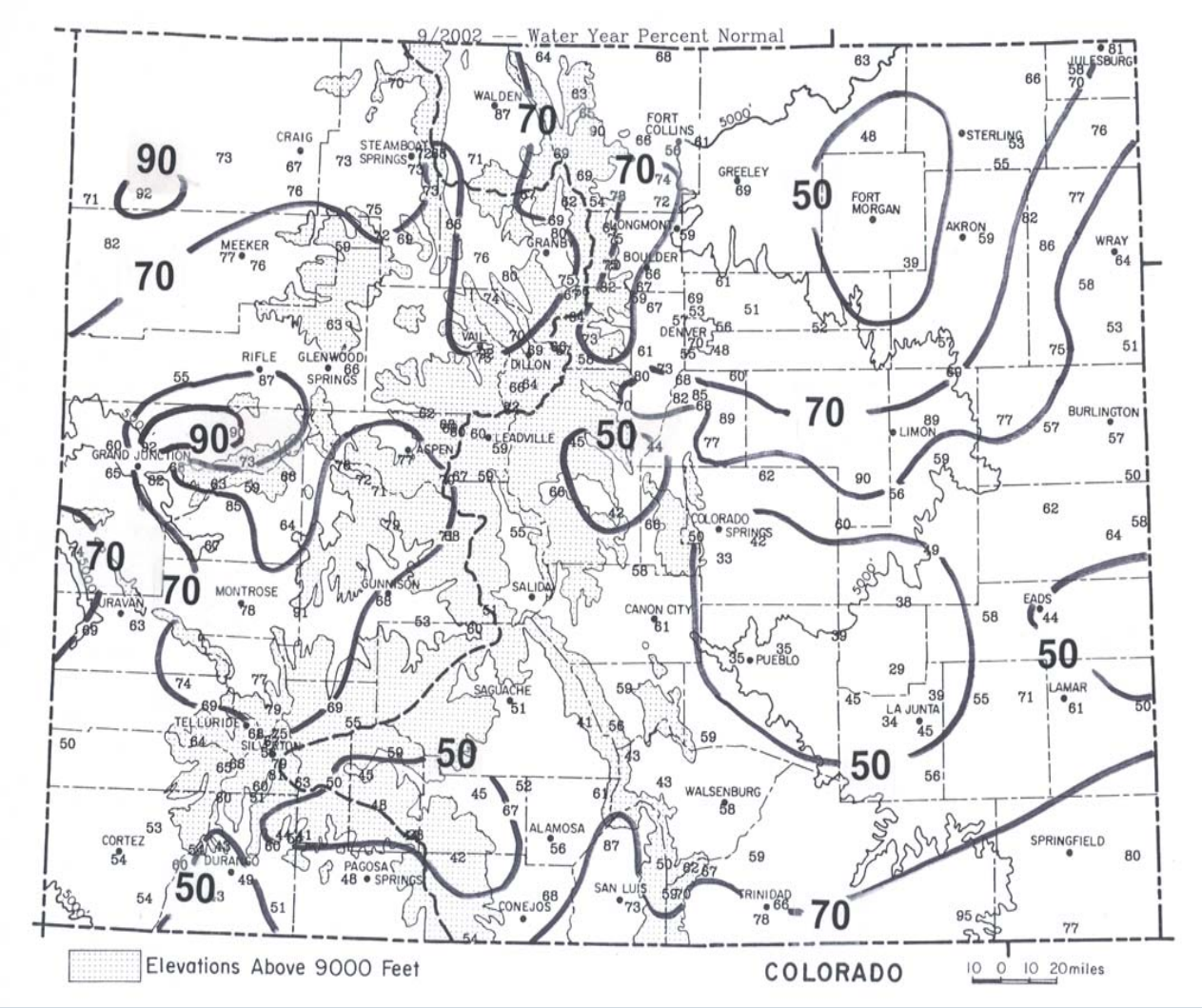
September 2002
Wet Weather at Last!

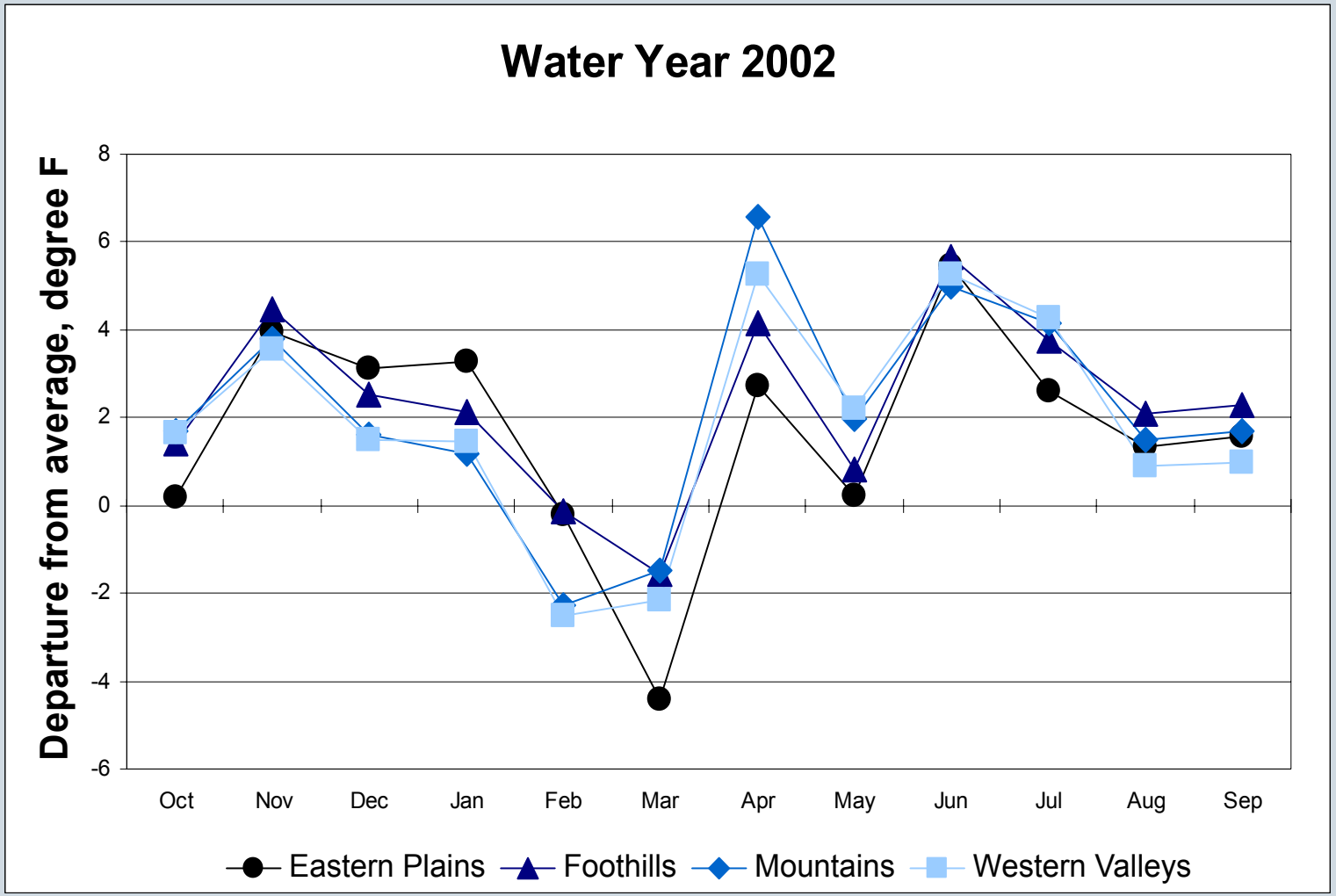


2002 Water Year in Summary

- Dry all parts of State
- Dry all seasons
- Steamflows lowest on record for many rivers
- Record summer heat
- Very high evaporation rates
- Far-reaching impacts from minor inconveniences to extreme economic hardship

Oct-Sept. 2002 WY % of Average

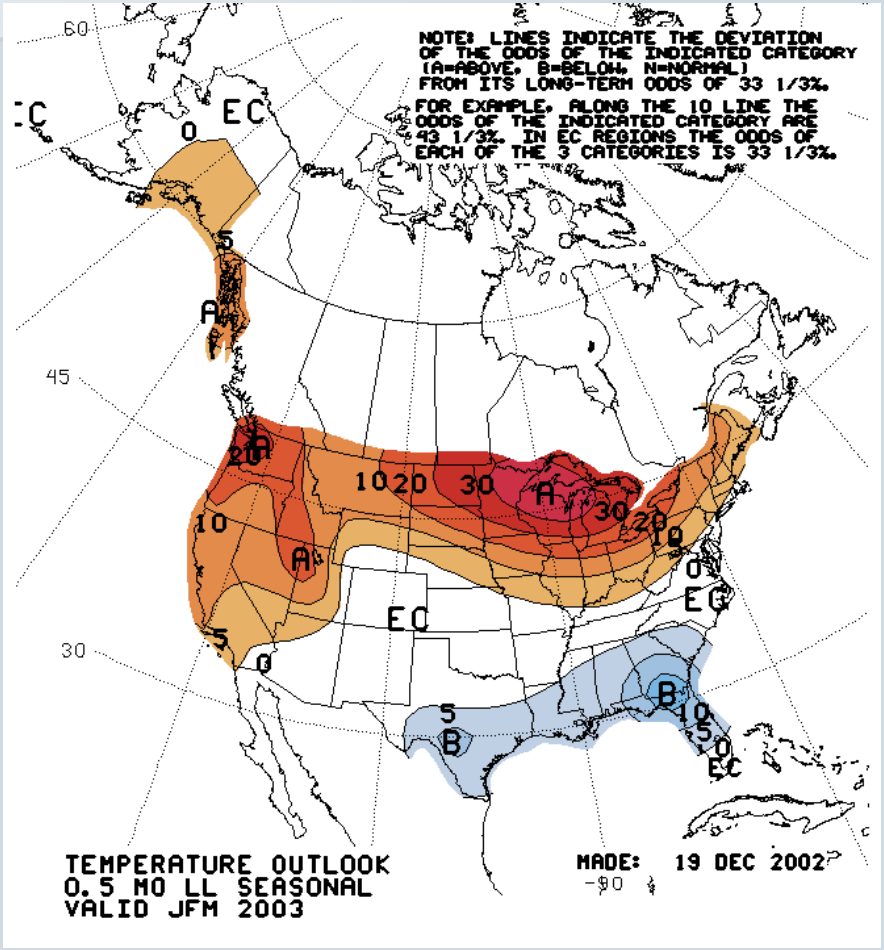



Water Year 2002
Departure from average, degree F
8
6
4
2
0
-2
-4
-6
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Eastern Plains
Foothills
Mountains
Western Valleys

What Happens Next

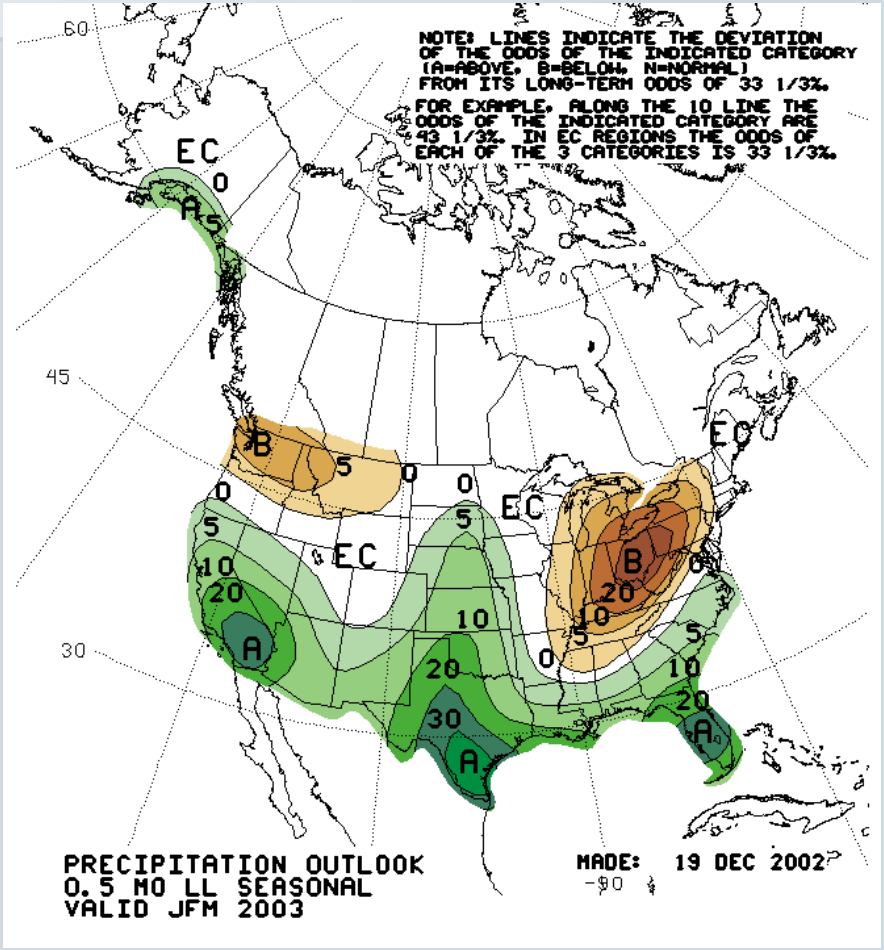
- We have never experienced 2 consecutive extreme statewide drought years.
- Past multi-year drought, characterized by one extreme year preceded and followed by other dry year.
- Entire State rarely all recovers quickly and at the same time.
- Hope for the best, plan for the worst!!

Temperature Jan-March 2003



From the Colorado Prediction Center
http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html

Precipitation
Jan-March 2003



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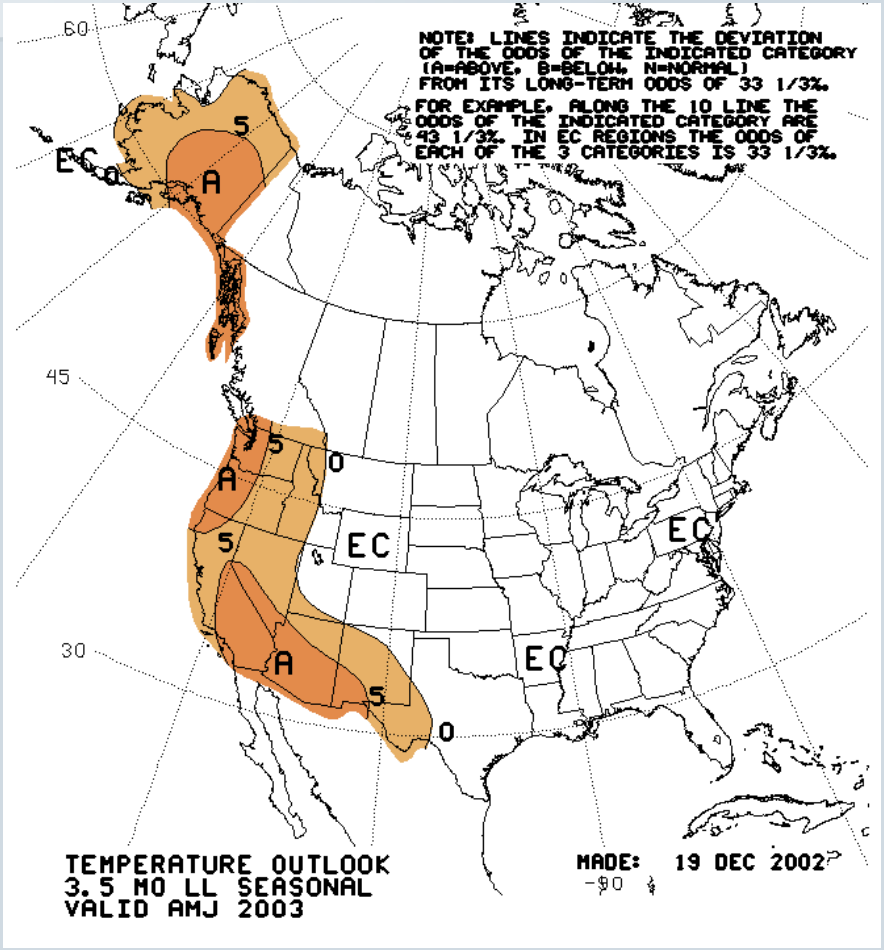
Temperature
Apr-June 2003



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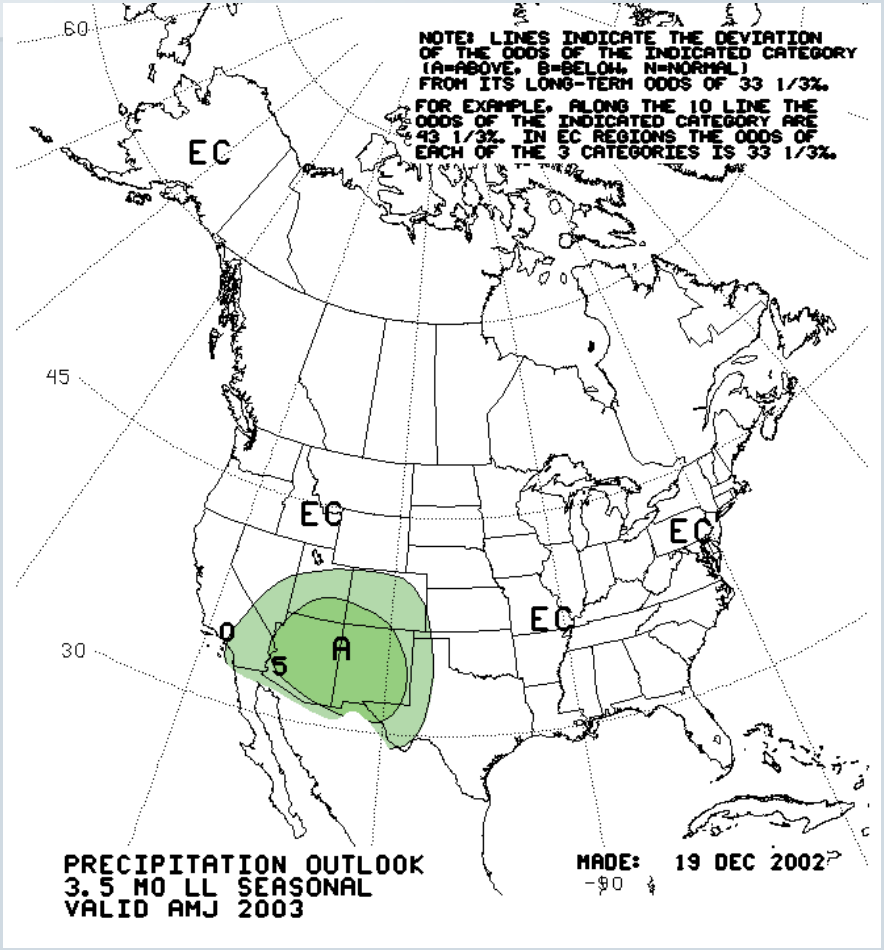
Precipitation Apr-June 2003



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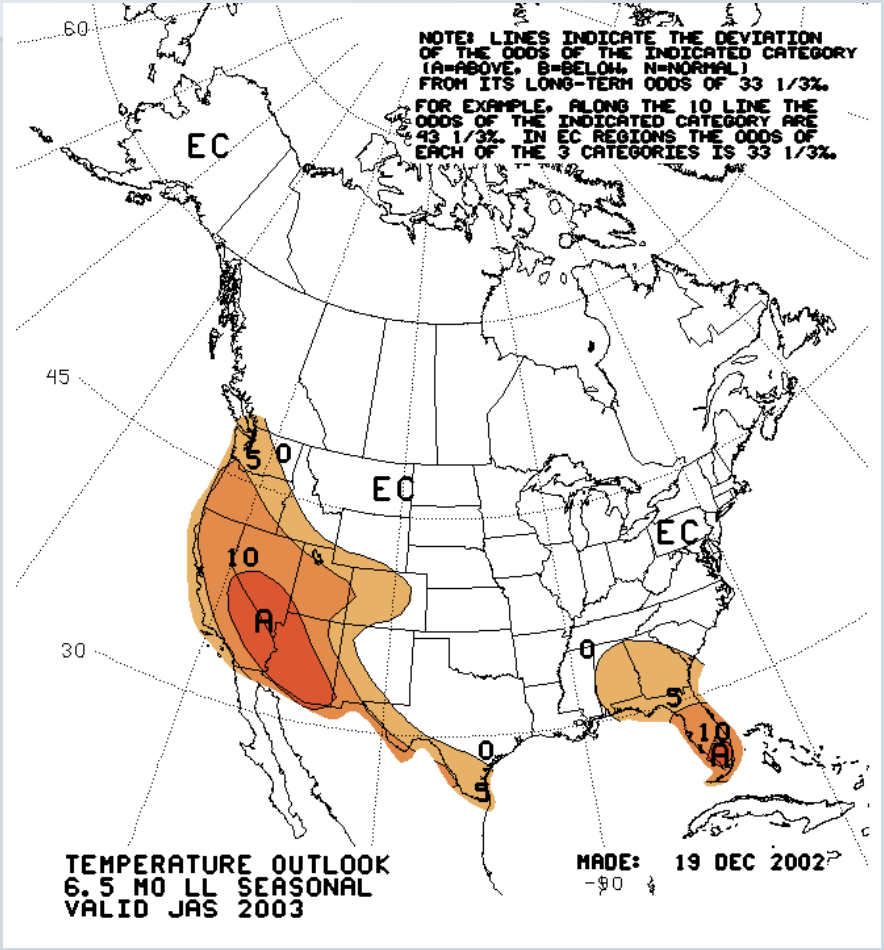
Temperature
July-Sept 2003



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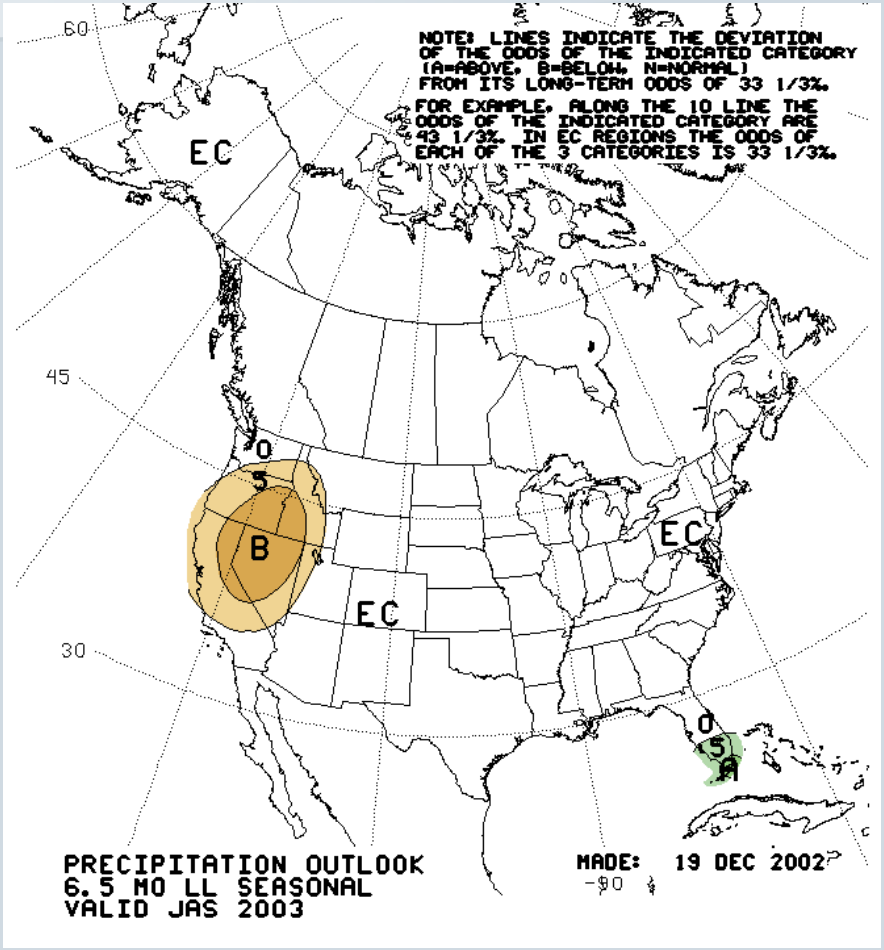
Precipitation
July-Sept 2003



From the Colorado Prediction Center
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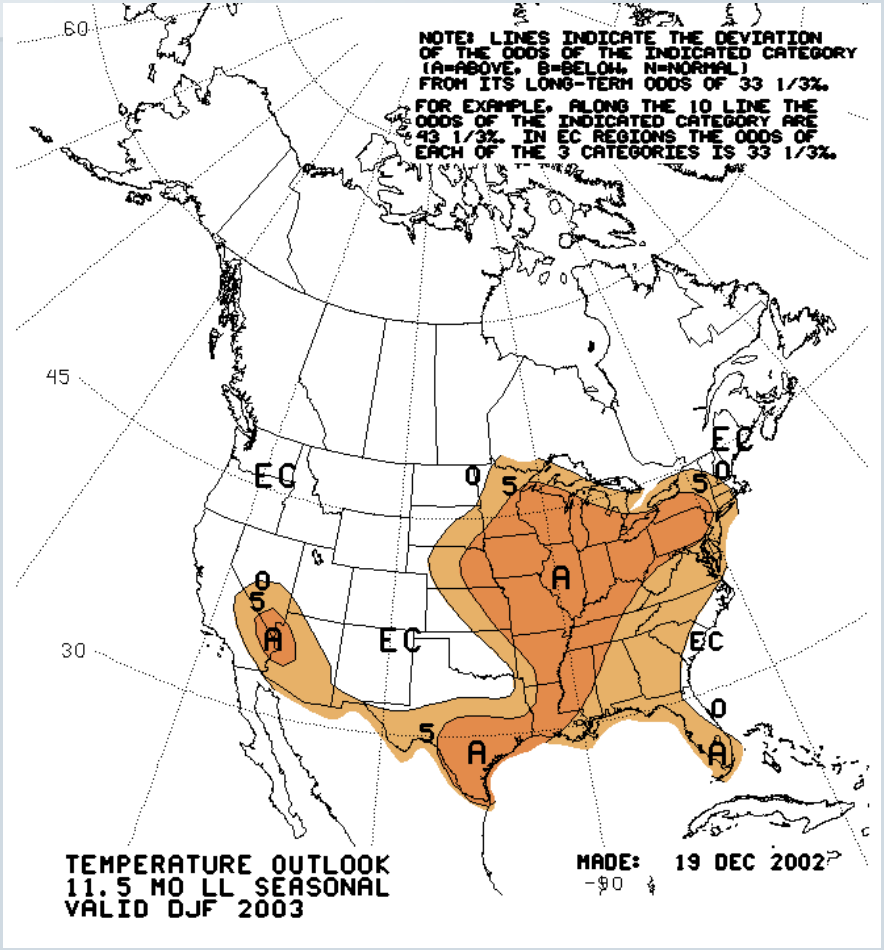
Temperature
Dec 2003-Feb 2004



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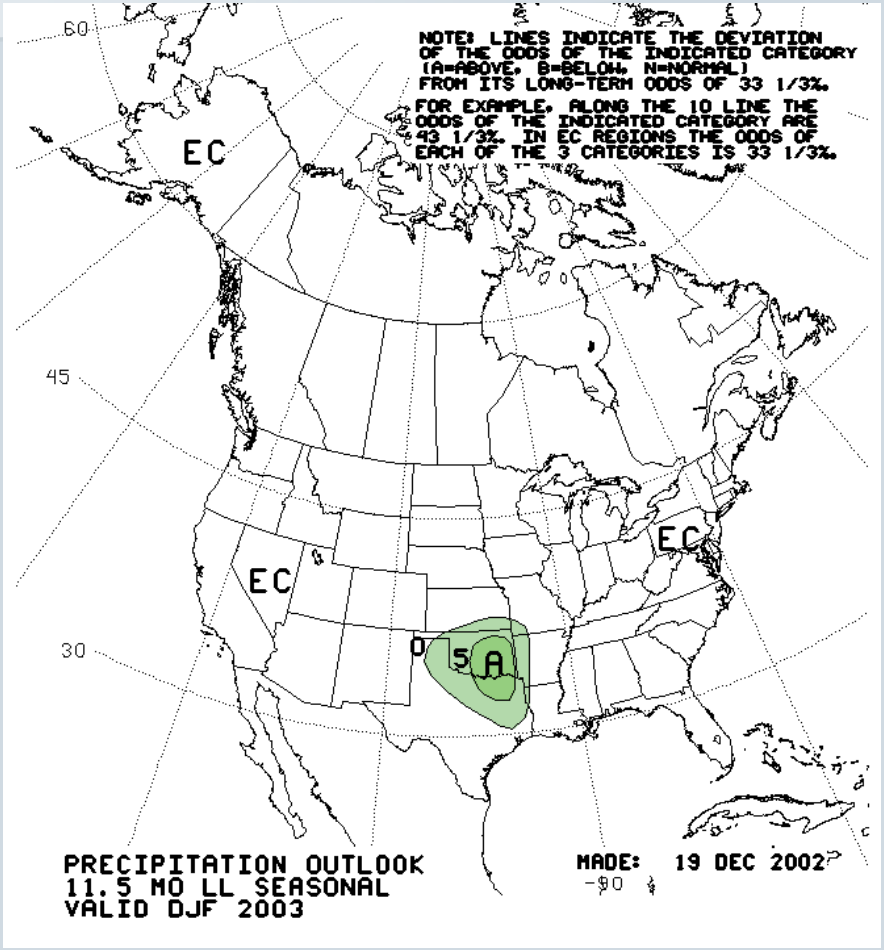
Precipitation
Dec 2003-Feb 2004



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Our Path For 2003